The Electrical Power Market in China

February 2001

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Ministère des Affaires étrangères et du Commerce international

Canada

101-02200/

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February 2001

(*Également disponible en français sous le titre, Le marché de l'électricité en Chine*)

Prepared by the
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and the
Canadian Trade Commissioner Service

© Department of Foreign Affairs and International Trade
(FaxLink no. 45142)

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THE ELECTRICAL POWER MARKET IN CHINA

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EXECUTIVE SUMMARY

In 1978, the Chinese government implemented its policies of market liberalization and economic reform. As a result, China's economy has more than quadrupled in size. China's electrical power sector has also developed at a breathtaking pace. It is currently the largest energy-consuming market in the world and the second-largest power-producing country, after the United States.

The installed power capacity has increased by an average of 10 gigawatts (GW) every year, reaching a total installed capacity of 277 GW by the end of 1998. This figure is expected to reach 315 GW by the end of 2000. In sharp contrast with its experience of only a generation ago China has now essentially achieved a demand-supply balance in terms of electrical power needs. Experts now warn, however, that with accelerating economic activity, continuing foreign investment, and a growing consumer class, regions of the country may, again begin experiencing energy shortages, particularly in peak periods. In the first half of 2000, China's electricity use increased over 10 percent nationwide, and more developed southern and coastal areas showed even greater growth, reaching over 20 percent in some cases.

Chinese power sector planners and operators are therefore concentrating not only on short term industrial restructuring and increased efficiencies, but are still overseeing medium- to long-term energy requirements. China's recent and substantial increase in generating capacity has created a corresponding requirement for transmission, distribution and power systems equipment as well as environmental control systems. In its 10th Five-year Plan (2001-2005), the government is putting greater emphasis on improving regional networks and nation-wide connectivity. Specialized equipment and services to update China infrastructure are in strong demand. China is placing a rapidly growing emphasis on alternative and cleaner fuels for power generation.

Thermal power is China's main source of energy accounting for 81.6% of total power generation, hydro accounts for 17.2%, followed by nuclear and other sources at about 1.3%. Over the next 10 years, China plans to significantly expand reliance on hydroelectricity by increasing the number of new hydroelectric power projects and refurbishing older inefficient plants. Installed capacity during the next 15 years will increase from 75 million kilowatts (kW) in 2000 to 150 kW by 2015. The country will

allocate further investment to enhance the national power grid system, which is centered on the Three Gorges Hydroelectric project, scheduled for completion by 2009.

As in most countries, when conducting business in China, the use of a local agent or distributor is recommended to assist with language, customs clearance and servicing requirements. In China, a strong local presence, whether on an independent basis or with a Chinese partner or representative is also critical to navigating the sometimes daunting and opaque maze of rules, regulations and practices. China' s pending accession to the World Trade Organisation (WTO) will help liberalise market entry and improve the business environment. However, change will be gradual. Canadian companies, especially those new to the market, are strongly advised to work with Canadian diplomatic posts in the country, as well as other Canadian support agencies.

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MARKET OVERVIEW

Over the past decade, China's power sector has developed at a breathtaking pace, making it the second-largest power-producing country in the world, after the United States. China has largely achieved a power demand-supply balance, fostered by slowing economic growth and a decline in traditional industrial activity. The central government's 10th Five-year Plan is aimed at improving efficiencies and expanding the country's transmission and distribution systems. Environmental considerations are also increasingly important, resulting in the closure of small and/or older generating facilities, and an indefinite ban on new small thermal plants — those below 300 megawatts [MW]. "Conventional" thermal power plants (except co-generation) have also been temporarily prohibited. Nevertheless, power demand continues to grow by approximately 10% in several parts of the country, raising prospects of regional shortages if new generation capacity is not developed.

China has set the following five principles for the development of the electric power sector for the 2000-2010 period:

- acceleration of large-scale hydroelectric power development and further evolution of cascade small-scale hydroelectric power projects;
- increase the use and development of new energy including wind-driven power, solar and biogas for power generation;
- prioritize power-generating technology driven by environmentally friendly coal;
- accelerate construction and interconnection of a nation-wide power grid; and
- continue nuclear power station development.

Installed electrical capacity in China more than doubled from 1990 to 1998. At the end of 1998 it stood at 270 GW — an increase of 400% since 1980. However, an estimated 70 million people are still without access to power, and per-capita consumption is about 1/28th of Canada's rate, ranking China 80th in global per-capita consumption. A relatively high percentage of power consumption, 58%, is still borne by heavy industry, with residential demand accounting for 12% of total demand.

At 81.6%, thermal power is China's main source of power generation. Hydro accounts for 17.2%, followed by nuclear and other sources at about 1.3%. China plans to significantly expand reliance on hydroelectricity in the next 10 years, supported by the

output of 18 200 MW of the Three Gorges power station by 2009, the world's largest hydroelectric project.

Table 1. Electricity Generation in China

	1995		2020	
	Twh	**%**	**Twh**	**%**
Solid Fuels	767	74	2612	67.7
Hydro	191	18.4	726	18.8
Oil	63	6.1	257	6.7
Nuclear	13	1.3	127	3.3
Gas	2	0.2	123	3.2
Other Renewable	0	–	11	0.3
Total	**1036**	**100**	**3857**	**100**

Source: The International Energy Administration. *China's Worldwide Quest for Energy Security*, 1999.

China has set a number of targets for the power sector for 2001-2010. An additional 75 million kW of generating capacity will be put into operation. Hydroelectric capacity will be increased by 70 million kW in 2000 to 125 million kW by 2010 — by far the largest hydroelectric development program in the world. Plans to further develop and renovate the country's urban and rural power grids will be initiated, including the launch of 87 transmission and distribution projects and 1600 rural grid projects.

There have been significant changes in Chinese government ministries over the past 10 years that affect the industry. In March 1998, the Ministry of Electric Power was abolished and most of its previous functions were transferred to the newly established State Power Corporation (SPC). The State Council endorsed the SPC to manage state-owned investments. Consequently, the sector received greater impetus for power grid integration and expansion. At the end of 1997, SPC generated a total of 739 terawatt-hours (TWh) representing approximately 65% of the nation's total. In the same year, total installed capacity of SPC amounted to 153 GW. The following table outlines China's total installed capacity in comparison with the SPC in the end of 1999.

Table 2. China's Total Installed Capacity in 1999 (MW)

Item	Value
China's Total Installed Capacity in 1999	294000
SPC's Total Installed Capacity	147000
Newly Installed Capacity in 1999	17000
Hydro	4840
Thermal	12550
Big-for-Small	1060

Source: *Energy China Market Series*. "Depa..nent of Strategic Study and Planning of the State Power Corporation," February 2000.

To date, SPC controls approximately 80% of China's power assets. The massive corporation is by far the largest electric utility in the world. The SPC is currently undergoing a restructuring program during the 2000-2010 period to achieve certain objectives:

- intensify power industry management systems to separate government functions from enterprises by 2000;
- realize nation-wide network interconnection and separate networks from power plants;
- implement new regulations by 2010; and
- strengthen and modernize the SPC to international standards by 2010.

The SPC's large-scale power reform will allow for increased opportunities for foreign investment to develop China's nation-wide power grid as well as technical renovation projects in the electric power sector. The corporation expects to sell 845 billion kilowatt-hours (kWh) of electricity and generate $1.5 billion[1] of profit by the end of 2000. For more information on China's total installed capacity and generation, refer to Appendix 1.

Hydroelectric Power

China has the richest hydroelectric power resources worldwide. Total exploitable hydro power potential is estimated to be 376 million kW. At present, China has 11 large-scale hydro power stations of 1000 MW and above in operation. There are currently nine projects under construction including three of the world's largest power plants: Three Gorges (18 200 MW), Ertan (3300 MW) and Xiaolangdi (1800 MW). River diversions have been completed at the Three Gorges and Xiaolangdi project sites in 1997, indicating that the projects are on schedule, while Ertan is at a more advanced stage.

[1] All monetary amounts are expressed in Canadian dollars, unless otherwise indicated. The conversion rate to Canadian dollars is based on IDD Information Services, *Tradeline*, July 1999.

China's total installed capacity in operation at pumped-storage hydro plants is 2400 MW. An additional 3000 MW is under construction at Tianhuangping (1800 MW) and Guangzhou II (1200 MW). Approximately 300 million people rely on small hydro projects for electricity. Therefore, China is planning to step-up the per-capita consumption of electricity in rural areas of the country by constructing additional small-scale hydro projects.

At present, electricity consumption in rural areas is approximately 280 kW/h. However, this figure will be increased to 600 kW/h over the next 10 years. There are an estimated 45 000 micro hydro projects (under 25 MW) in operation and nearly 20 000 MW to be commissioned at a rate of more than 1000 MW a year. To date, China has only used 29% of total hydro resources available. The current booming hydro-power developments are set to create significant opportunities for foreign investment and new technology imports.

Transmission and Distribution

Over the past 20 years, China has focused its attention on the construction of power sources rather than distribution systems. As a result, development of electricity networks and distribution systems have lagged behind the increase in power demand. In 1998, China sought to balance the sector by launching a $297 billion country-wide project to reconstruct and upgrade urban and rural power networks. The project covers more than 300 cities throughout China and is estimated to have a four to five year implementation period.

At present, Chinese transmission and distribution infrastructure consists of five inter-provincial (or regional) power networks: Northeast, North China, East China, Central China and South China Electrical Power Joint Venture Network. The Central China power network has the largest grid with regard to transmission lines. The East China power network is the largest in China with a total installed capacity of 46 MW. There are eight independently operated provincial (autonomous regional and municipal) power grids in China: Shangdong, Fujian, Yunan, Guizhou, Guangxi, Guangdong, Hainan and Chuanyu.

All cities and most rural villages in China have been linked to the power grids. Statistics indicate that by the end of 1998, China's transmission and distribution network had a total length of 656 561 km of at least 35 kilovolt (kV) electrical lines installed. Of this length there were 20 093 km of 500 kV line, 7 291 km of 330 kV line, 115 645 km of 220 kV line, and 181 027 km of 110 kV line.

China will benefit from large-scale hydroelectric power development projects to lay the foundation of a nation-wide grid for transmitting more electricity from Western to Eastern China. The completion of the Three Gorges power station will allow for the

connection of the Central China grid and the East China grid. The northern and southern grid will be expanded and serve as passageways for the transmission of electric power from west to east.

Renewable Energy

China has become the largest renewable energy consuming country in the world. Renewable resources account for the second-largest share of China's electricity generation market after coal. The Government has stated that the tenth five-year plan (2001-2005) will be focused on applying renewable energy to the power sector and accelerating the commercialization of clean energy. During the past 10 years, consumption of coal and other energy sources has increased environmental pollution in China. The country currently accounts for 10% of global carbon dioxide emissions, the third-largest in the world after the United States and Russia. China's main sustainable development goal is to shift away from coal-fired power plants, and toward natural gas and renewable energy for electric power generation.

Despite booming economic development in China, there still remains an estimated 70 million people, many living in remote areas, that have no access to electricity. To remedy the growing demand for power in these regions, the Chinese government is implementing a long-term project aimed at taking advantage of the country's rich renewable energy sources. The program aims at improving the efficiency of renewable energy technology application and increasing the balance of renewable energy to overall power supply. From 2001 to 2005, the government intends to build a renewable energy development system to commercialize equipment and technology. By 2010, renewable energy will account for 1.5% — equivalent to 20 million tonnes of coal — of national energy consumption. The following table details China's renewable energy development targets:

Table 3. China – Renewable Energy Installed Capacity and Forecast

Year	1998	2000	2005	2010
Solar PV (MW)	13	16	26	56
Solar water heater 10^4 m^2	1500	2600	7300	17100
Wind farm (MW)	223.6	500-600	1,000-1,500	3000
Stand-alone wind turbine (MW)	17	41.9	133.8	429.3
High-temperature geothermal generation (MW)	25	30	40-50	75-100
Middle/low geothermal space heating 10^4 m^2	800	950	1,400-1,500	2,200-2,500
Biogas from industrial biogas engineering 10^8 m^2	3.2	4.8	12.8	24
Biogas from agricultural waste biogas engineering 10^8 m^2	0.6	0.6	1.2	2.8
Crop straw gasification gas supply 10^8 m^2	0.7	1.6	6.1	12.9

Source: United States Department of Commerce. *Renewable Energy China*, 2000.

At present, the country has vast wind resources concentrated in the north, stretching from Xinjiang Autonomous Region in the west to Inner Mongolia in the east, as well as along coastal regions such as Guangdong Province, and the East and South China seas. There are currently around 150,000 sets of wind-chargers in operation throughout the autonomous region. Solar energy use in China is still small-scale, such as household consumption, television relays and communications.

Thermal Power

China has significantly improved technical equipment standards in the country's thermal power industry. At the end of 1998 there were 467 generating units of 200 MW capacity and above, totaling 126,055 MW. In 1978, there were only 18 similar units in the country. Large scale thermal generating units have become the primary source of electric power in China. At the end of 1998, there were 68 large-scale power plants with GW capacity in operation, 11 of which were hydroelectric power stations, with a further 32 under construction. There are also 401 thermal and nuclear generation units with a capacity of at least 200 MW.

The production output of pit-mouth power plants is expected to increase to account for 40% of thermal power output. The central government plans to construct new pit-mouth plants in Shanxi, Shaanxi, Henan, Guizhou and Yunnan provinces, Inner Mongolia and Ningxia Hui autonomous regions.

China's coal-fired power plants account for about 80% of the nation's electricity generation. The power sector and industrial coal-fired boilers are the first and second-largest polluters respectively. Consequently, China is the largest producer of sulphur dioxide in the world. At the same time, industrial particulate discharge has also increased dramatically, and vehicle emissions are becoming a major source of air pollution in more developed cities such as Beijing, Shanghai, Guangzhou and Tianjin. China recognizes the need to improve its air quality, and has adopted various measures, which include closing inefficient thermal electric power plants in order to curb carbon emission growth. In addition, the industry will increase the use of flue gas desulphurization equipment in power generation plants, electrostatic precipitations, cleaner coal technology and environmental monitoring equipment.

Nuclear Power

China's nuclear energy program currently consists of three operating reactors in two plants, the Qinshan (1 x 300 MW), and the Daya Bay (2 x 900 MW) nuclear power plant, with an installed capacity of 2,100 MW. An additional 6,600 MW is under construction and is set to contribute 20 million kW of nuclear energy to China's power supply by 2010. Of this total, 6.6 million kW will be the result of four nuclear power plants projects that are expected to come on-line between 2001-2005.

Table 4. China Nuclear Power Projects 2001-2005

Project Name	Location	Installed Capacity (MW)	Construction Period	Source of Financing
Qinshan (2nd phase)	Zhejiang	2 x 650	1998-2003	
Qinshan (3rd phase)	Zhejiang	2 x 720	1998-2003	Canada
Ling'ao	Guangdong	2 x 1000	1998-2003	State Development Bank of China
Tianwan	Jiangsu	2 x VER-1000s	1997-2005	Russia

Source: *Asia Pulse*. "China to open four more Nuclear Power Plants," July 2000.

As a result of a slowdown in the growth of the electricity market, China's ambitious plans for nuclear power development are currently being re-evaluated. Unless there is a dramatic turnabout in electricity supply and demand situation, it is not likely that there will be any further nuclear projects in the next few years.

South China Electrical power market

In an effort to rationalize its energy structure to practice economic and environmental protection, Guangdong is reforming its electric power industry after 20 years of unregulated development. It is also answering the call of the central government to optimize resource allocation and to achieve sustainable growth. The provincial government's power strategy includes building generating plants near the source of energy, streamlining power supply administration, and establishing a regional and national power network.

As a large electricity-consuming province due to its ongoing economic boom, Guangdong has built many power plants since the 1980s, including thermal, hydro, nuclear, and small wind-power plants. Nevertheless, coal and diesel-fired power plants account for 70% of both installed capacity and generation capacity.

Under the previous Ministry of Electric Power, power bureaus of different provinces constructed, operated and held controlling interest in many power generating plants in the province, as well as managing the power distribution system. The regime also allowed counties, towns and villages to obtain power from the provincial power grid and sell it to those lower in the chain, which resulted in high power costs, especially in rural areas. One direct result was that many enterprises and villages built their own small power plants, which severely polluted the environment.

Since 1998, Guangdong has invested $1.6 billion to upgrade its rural power transmission network. It is also unifying its power grid and streamlining the electricity supply administration by implementing the direct sale of power from the provincial grid to end-users through Guangdong Power Corporation Group (previously known as G.D. Power Bureau) and its agents. The corporation still controls power plants and power grids, but is expected to focus on the power grid construction and operation after the completion of the power industry reform.

One direct benefit of the reform is that Guangdong lowered rural electricity prices under $1 per kW/h at the end of 1999. Concerned for the environment, Guangdong is starting to shut down small coal-fired power plants with generation capacities under 25 MW. However, together with the phasing out of old diesel fired power plants and the low water levels of hydro power plants, Guangdong is confronting a shortage of power.

One measure to cover the shortage of power is to import electricity from more distant provinces, such as Yunnan, which is rich in hydro power generation resources. Guangdong also recently signed a procurement contract with Guizhou to buy 1500 to 2000 MW of power until 2003, and between 3000 and 4000 MW in 2005, with volume increasing as necessary. This also contributes to China's Western Development Plan. Besides west-east power transmission, China is also developing a north-south power

transmission strategy to optimize its energy distribution system. The completion of the Three Georges project will add to the free trading of power on the national power grid.

Key Factors Shaping Market Growth

During the first quarter of 2000, China invested $3.32 billion in the development of the electrical power industry, representing a year-to-year increase of 18%. Of this investment, $1.7 billion was allocated to infrastructure projects, $53.8 million to replacement projects consisting of small- to large-scale power projects, and $1.5 billion toward power grid construction and upgrading of rural and urban areas.

In May 2000, the Chinese Government announced its Western Development Strategy aimed at bringing economic restructuring and increased foreign investment in the remote and underdeveloped region of Xinjiang Province. Over the next 10 years, the Chinese electrical power sector led by the SPC, will invest $7.8 billion in Xinjiang Province to transmit power from the western to the eastern part of China. The nation-wide power grids will be connected by 2020. Significant prospects for exports in China's Western Development Plan exist in the supply of electrical equipment and services, primarily in the areas of transmission and distribution. This massive campaign parallels China's $7.4 billion, 4200 km long, west-east natural gas pipeline project.

In 1997, the SPC was involved in 96 power projects utilizing foreign funds to build approximately 62,341 MW of capacity. This total included 63 thermal power projects (41,720 MW); 25 hydro power projects (17,620 MW); two nuclear power projects (3,000 MW); and six transmission and distribution projects. Total foreign investment projected was $35 billion.

SPC investments for 2000-2010 are focused on seven priority projects, including grid building in Northeast and North China, power transmission and conversion projects at the Three Gorges, interconnecting power grids in Fujian and East China, power grids in Northwest and Central China, Central and East China, Sichuan and Northwest China, and in Shandong Province and North China.

In 1998 and 1999, environmental issues pushed the central government to invest heavily in hydro power production. The SPC's current restructuring program is driving the electric power sector toward market competition and is opening opportunities to direct foreign investment in hydro power production. In 1998, $1.2 billion was invested in the construction of five major hydro-electric power plants. China's economic developments in hydroelectric projects should boost the demand for foreign technology and equipment in the sector.

China is urging investors to build small hydro power stations (SHS) in the country. At present, SHS potential is approximately 100 kW with more than 40,000 SHS in operation. Installed capacity for SHS was 29% at the end of 1999. The majority of

stations have been functioning for 30 to 40 years and are in need of transformation and equipment renewal. China's national sustainable development drive through SHS includes the electrification of 400 counties by 2005, and 400 more by 2010.

Notwithstanding the uncertain regulatory and legal regime which still governs foreign investment in the power sector, the central government is encouraging foreign businesses to channel funds into the following areas:

- construction and management of thermal power plants with a unit capacity of 300,000 kW and above;
- construction and management of hydro power stations;
- construction and management of nuclear power stations (the central government will retain a controlling stake);
- construction and management of power plants involving clean coal burning technology; and
- construction and management of power stations exploiting new energy (including solar, wind, magnetic, geothermal, tidal, and biological substance energy).

Following the World Energy Summit in 1996, the Chinese government launched a national renewable energy campaign called the "Brightness Program". The objective of the ongoing program is to reduce poverty and improve the standard of living of people in remote areas of the country. Specifically, it focuses on areas that are inaccessible to the power grid. The project will require an annual investment of $360 million/year. This will cover the costs to equip approximately 23 million people for use of electricity by wind and photovoltaic solar panels (PV) technologies by 2010. The first phase of the project is currently under way, and includes the electrification of 8 million people, 2000 villages, 100 border stations and 100 microwave stations. Currently, the Chinese renewable energy equipment market is limited. Consequently, the development of the "Brightness Program" represents significant prospects for Canadian manufacturers of renewable energy equipment and services.

China is currently initiating one of the largest publicly funded renewable energy projects, worth $658 million. China is aiming to use up-to-date technologies to install 190 MW grid-connected wind farms in four provinces. Additionally, municipalities and institutions in remote areas of six northwestern provinces will be supplied with PV systems. The World Bank has approved a $147 million loan and a grant totaling $51 million for the project. It currently has a five-year implementation period from 1999-2004.

Key Factors in South China Electrical Power Market

According to the Guangdong Power Corporation Group and the Guangdong Economic and Trade Commission, the provincial government is currently discussing the final reform plan for the industry. One possibility is the opening of the power generating

market, which means the equity the Guangdong Power Corporation has in power plants will be sold and domestic and foreign firms will be allowed to buy and operate these power plants. Although this is still under discussion, some foreign electric companies are rumored to have visited for this purpose. Canadian companies interested in this market can access it by either purchasing local plants, establishing joint-venture power plants with local partners or providing power plant upgrading services to the new owners.

With the west-east power transmission goals, Guangdong is limiting the number of new power plants except those projects that have been approved or are under construction. However, the provincial government is giving serious consideration to increasing the percentage of renewable energy sources for power generation and thus welcomes Canadian expertise in this area, especially wind, solar and fuel cell power.

Wind power is the most achievable generation source in the Guangdong renewable energy sector. The Guangdong power industry plans to increase total wind-generating capacity from 42 MW in 1999 to 80 MW in 2000; and is expected to reach150 MW by 2010; and have an additional 100 MW by 2020. Provision of technology and equipment for these facilities represents significant opportunities for Canadian renewable energy equipment manufacturers.

Other technologies needed include clean coal burning technology. Guangdong introduced low sulphur coal from other provinces, but still suffers from acid rain. Given the high cost of the desulphurization facilities, it is seeking alternative technologies to clean the coal while burning.

Besides the province of Guangdong, Fujian and Hainan are also reforming their power network. Fujian is investing $843 million to improve its power grid over the next three years, while Hainan is investing $305 million to upgrade its power grid and to lower its power cost to 0.14 per kWh. Guangxi is participating in the west-east power transmission, buying power from the Guizhou and Yunnan grid, while at the same time, selling electricity to Guangdong.

Opportunities

Developments in China's hydroelectric power projects as well as transmission and distribution market offer continuing opportunities for Canadian companies in the local electric power market. Canada has historically played a major role in the development of China's power sector, particularly in the field of project management and engineering consulting. This foundation has served as a springboard for companies to not only continue to be active in traditional areas of activity, but also to expand into information management, training and, increasingly, into equity holdings.

It is anticipated that China's electrical power sector will continue to invest heavily over the period to 2010 to construct new generating capacity, additional transmission lines, clean coal technologies and improve end-use efficiencies. Because of current over capacity it is estimated that planned development will also be directed at modernizing existing facilities and creating alternative processing capacities.

Canadian companies can access specific project proposals to supply equipment and services to the Chinese electric power sector through Industry Canada's Electric Power Virtual Trade Network. For more information, contact Industry Canada (see **Canadian Government Contacts**) or register via the Internet (http://napoleon.ic.gc.ca/ttcelectrical).

Strategies for entering the Chinese market may range from the promotion of turnkey independent power producers (IPPs) to the exploitation of niche markets for highly specialized goods and services. Niche opportunities continue to exist for Canadian companies in thermal power plant development and upgrading. Moreover, mini- and micro-hydro and alternative power sources such as biomass, wind, ocean and solar energy, are also gaining considerable profile. Canadian firms may enjoy competitive advantage in the following areas:

Hydroelectricity

- supplying, constructing and upgrading hydro-electric power plants;
- security systems for electric power stations;
- electric-hydraulic speed regulation system;
- selection static excitation system;
- 500 kV FS gas-insulated switchgear installations;
- advanced manufacturing, transportation and heavy duty welding technologies;
- hydraulic turbines, key equipment and devices for advanced manufacturing, transportation and assembling technologies;
- 500 kV DC electric power transmission technology and systems;
- computer-based centralized control systems for large-scale hydroelectric power plants;
- large-sized navigation locks and ship lifts;
- steel cable hoisting, locking devices, electronic components, and computer-based control systems for large-sized ship lifts;
- dredge and related equipment;
- key equipment for the construction of high volume concrete dams;
- equipment and technologies for the maintenance of dams on large rivers;
- soil construction technologies;
- waterproofing materials;
- weather forecast equipment and technologies; and
- flood forecast equipment and measuring technologies.

Transmission and Distribution

Canadian companies can exploit opportunities in the sale of specialized equipment and services for automation and control systems (including computer hardware and software), remote sensing equipment, insulation for high-voltage transmission lines as well as security and safety equipment, protection devices and systems for switching equipment and generators. China has placed a number of restrictions on imports of equipment for the alternating current (AC) sector while continuing to promote domestic equipment in the Direct Current (DC) sector. Canadian equipment manufacturers can focus on the DC section as well as the sale of the following equipment related to transmission and distribution:

- control systems;
- insulating devices and technology for high-voltage transmission lines;
- protection devices for switches, generators and other sensitive equipment;
- power transmission support towers;
- vehicles and equipment to support, analyze and repair high-voltage transmission lines and support structures;
- heavy transport equipment (all-terrain and airborne transportation to remove or replace equipment in areas of limited access);
- grid management software;
- medium and heavy-duty transformers and capacitors, as well as specialty wires and cables;
- transmission equipment and services, design and construction of 400-500 kV lines;
- equipment for high-voltage and extra high-voltage networks;
- transformers;
- switch gears;
- electric grid equipment;
- measuring systems for energy distribution; and
- special valves.

Renewable Energy

China is strongly supporting biogas, small wind turbines and solar power development to provide energy to its isolated rural population. Past experiments have indicated that off-grid wind and PV technologies are feasible for the provinces of Inner Mongolia, Gansu, Xinjiang, Qinghai, Ningxia, Guangdong and Tibet as well as islands along the coast. Opportunities might be exploited in the following areas:

- solar heaters and solar PV;
- wind farm for large scale wind generation, stand-alone wind generation;
- wind turbines, wind blades and heads, and wind power control systems;
- geothermal power generation and geothermal space heating;

- large/middle size biogas engineering using industrial or agricultural waste water;
- crop-straw gasification;
- power-related environmental equipment and technologies;
- steam boilers and parts;
- water heaters, air heaters, steam and heat accumulators;
- gas generators;
- steam turbines for electricity;
- turbines related to tidal, wave and biomass power generation;
- regulators and rotors;
- gas turbines;
- pumps and vacuum pumps;
- wind generators;
- fuel batteries; and
- electrical wires and connectors.

Thermal Power Generation

The State Bureau of Machine-Building Industry recently confirmed that China will focus on development of large-scale thermal power generating equipment. Priority will be given to super-critical generating units at 3400 MW capacity using imported equipment as well as air-cooling generating units, circulating fluid-bed furnaces of 100 MW and above, conventional gas-steam integral units, and large-scale gas turbine engines.

Given China's heavy dependance on coal for thermal power generation, interest in clean-coal technologies has been increasing. As new generating installations are built, particularly privately financed plants, there will be a trend toward modernized combustion processes such as stage burners, reburning and fluidized-bed combustors, as opposed to the pulverized coal systems now in use. It is anticipated that there will be a trend toward for post-combustion emission-control technologies, including flue-gas scrubbing systems and fly ash utilization programs. Opportunities can be found in the following areas:

- renovating and modernizing coal-fired power plants;
- steam or other vapor generating boilers;
- parts for steam, vapor generating, super-heat water boilers;
- auxiliary plant for boilers of heading and parts;
- gas or water generators;
- flue gas desulphurization equipment and related technologies;
- instrumentation and control systems;
- ash handling systems;
- electro-filters for coal and gas power stations;
- additional equipment for emission reduction and control of existing boilers;
- equipment for gas-steam cycle;
- steam turbines and other vapor turbines;

- gas turbines;
- gas purification equipment; and
- co-generation equipment.

Nuclear Power Generation

China's nuclear program is creating opportunity for Canadian equipment manufacturers in the following niche areas:

- electrostatic precipitations for power stations;
- innovation technologies for waste disposal that will allow the transformation of ash and slag into building materials; and
- technologies, products and services for nuclear plant modernization, including equipment for upgrade of fire and nuclear safety systems.

South China Market (Guangdong Province)

South China's electric power industry is expected to develop at an annual growth rate of 10% between 2001 and 2010. Planned power plant projects will require foreign equipment in the following areas:

- nuclear reactors;
- nuclear fuel;
- turbine island and turbine bypass systems;
- gas turbines;
- coal handling systems;
- ash disposal systems;
- distributed control systems;
- high-temperature desulphurization devices and high-temperature valves; and
- coal pulverizers.

Actual and Planned Projects

Hydroelectric Power Projects

Three Gorges Hydroelectric Project

The Three Gorges Project is a significant milestone in China's drive to create a nation-wide integrated power grid. Built along the Yangtze River, the project involves the construction of 26 hydro power generating units of 700 MW each, which will produce a total of 84.7 Twh a year. The project has an official cost of $38 billion, excluding the transmission components. The SPC will begin construction of one of the three lines to Changzhou in Jiangsu Province. Of the Three Gorges total capacity, 12 000 MW will be transmitted to Central China, 4200 MW to East China and 2000 MW to Chongqing. In

addition, SPC will construct 15 transmission lines (550 kV) stretching 9100 km. Transmission lines will be completed by 2008, one year ahead of the completion of the Three Gorges power station. As a result of the Three Gorges project, a massive construction program is currently under way in Sichuan and Hubei Province to build replacement towns, roads and factories for those people who will be relocated.

Xiaolangdi Hydroelectric Project

The central government is developing the $5.9 billion Xiaolangdi multipurpose project. Ministry of Water Resource received a loan from the World Bank in the amount of $3.6 billion, representing the bank's largest commitment to China. An important factor to the multipurpose project is that 454,000 people will be affected by the project and will need to be resettled to different areas. China is set to redevelop townships and villages through irrigation and land development schemes and ensure that standard of living will be improved. The second stage project includes the construction of a dam and a 1,800 MW hydroelectric power plant on the Yellow River. It is expected to be completed in 2001.

Ertan II Hydroelectric Project

The Ertan II Multipurpose Hydroelectric Project, located in Western Sichuan, is currently under development. The 245 m-high arch dam will create a reservoir volume of 5,800 m^3 that should be completed at the end of 2000. The project is being funded by a $590 million loan by the International Bank for Reconstruction and Development (IBRD). The Ertan dam is part of a planned series of 11 dams along the Yalong River Valley that will eventually produce 19 800 MW. The total installation capacity of Sichuan is 6435 MW, in which Ertan accounts for 3300 MW.

Other Hydroelectric Projects

China received a $878 million loan from the IBRD for the procurement of goods and services for the Guangxi Base Multipurpose project. The project involves the protection of Nanning and nine other municipalities and counties against floods. The Baise Dam and Power Facilities components will consist of a 130 m-high dam and spillway, power facilities including a hydro-power plant of 540 MW, two saddle dams and underwater works for navigation ship lift. The institutional development component includes strengthening the Youjiang River Basin Development Corporation, development of a flood forecasting and monitoring system and operational procedures including institutional reform, environmental management and a resettlement program. Consultants for project preparation and feasibility studies have been selected and implementation procedures were under way as of August 1999.

In October 1996, China received a $443 million loan from the IBRD toward the cost of the Liaoning Pushile Hydro project. The project will include:

- construction of a pumped storage facility in Liaoning Province with an installed capacity of 4 x 300 MW;
- 320 km of 500 kV transmission lines;
- engineering management services;
- 270 km of fibre optic cable upgrades for Northeast Power Group (NEPG) communications; and
- technical assistance and training for NEPG to implement industry reforms and management.

The Liaoning project is ongoing.

In July 2000, the central government announced the construction of the $259 million Yinzhidu Hydroelectric Power Station in Guizhou Province. The station will be located on the Sancha river, in Guizhou Province, and will have a height of 125 m. Storage capacity is estimated to be 490 million m^3. Once in operation, the station will generate approximately 240,000 kW and will produce 883 million KW/h annually. At present, there is no time schedule for construction.

China has applied for a $148 million loan from the IBRD for the Hubei Hydro power Project to build four medium-sized hydro power plants. The project will be located in West Hubei Province and will consist of the building of dams, powerhouses, power tunnel switch yards and access roads. Canadian exporters can seek opportunities in the supply turbine-generator units and auxiliary equipment, plant control systems, main power transformers, and switchyard equipment. Each hydroelectric plant will have the following components:

- Dongping plant: dam type – double curvature arch (134 m height); 2 x 55 MW capacity;
- Xiakou plant: dam type – double curvature arch (85 m height); 3 x 10 MW capacity;
- Lajitan plant: dam type – concrete gravity (39 m height); 3 x 12 MW capacity; and
- Songshuling plant: dam type – concrete gravity (66 m height); 4 x 12.5 MW capacity.

A general procurement notice from the World Bank was issued in March 2000. No deadline has been set for project implementation.

In June 2000, China and Thailand signed an agreement for the joint construction of the Jinghong power station on the Lancang River. The project will have a total value of $1.4 billion, will begin in 2006 and take six years to complete. It will consist of five 300 MW plants for a total of 1500 MW. Upon completion, the station will transmit about 1.5 million kW of electricity a year to Thailand.

The construction of the Xiaowan hydro power station (consisting of six 700 MW units) is planned by the Yunnan Electric Power Group Inc. and the Yunnan Planning Commission. The feasibility study has been completed, and the project is currently awaiting approval from the central government. Once approved, construction will begin in 2002 and finish in 2009.

In August 2000, Guizhou Province in Southwest China announced that it is seeking foreign investment for the $2.1 billion Wujiang Goupitan Hydro power project. Once complete, the station will have an annual generating capacity of 8.53 billion kW/h. Co-operation in the form of a joint venture is preferred.

China plans to build 25 large and medium-sized hydroelectric power stations along 918 km of the upper reaches of the Yellow River starting from Qinglongxia in Qinghai Province to Qingtonxia in the Ningxia Hui Autonomous Region. The project requires a total investment of $1.1 billion yuan and was started in July 2000 and is expected to be completed by 2006.

In March 2000, Shaanxi Province announced that it is currently in planning and preparation stages for a $1.4 billion hydroelectric power development program along the Hanjiang River in Yangtze, Northwest China. A total of five hydro power stations will be built bringing total annual power output to seven billion kW/h. The project proposal is pending approval.

The central government announced in February 2000, that it will build four large hydro power stations on the Yalong river. The first station, Jinping 1, will have a storage capacity of 10 billion m^3 and a dam 325 m high. Construction is currently under way and no timetable has been set for project completion.

The Tongbai Pumped Storage Power Plant Project has a total value of $1.4 billion. Of this amount, $35 million is being funded by the World Bank and the remainder from local sources. The project began in 2000 and will end in 2007. The development will consist of:

- a new reservoir impounded by a dam with a maximum height of 69 m;

- two inclined shafts and tunnels with a total length of 1270 m to link the upper and lower reservoir;
- an underground powerhouse with an installed capacity of 4 x 300 MW; and
- the implementation of an environment plan, resettlement plan and consulting services to assist in engineering, design, procurement and construction management.

The transmission segment of the project will comprise of:

- reinforcement of transmission (90 km) of 500 kV double circuit lines, and a new substation of 1 x 750 MVA for connecting the power plant to the grid;
- reinforcement of the 500 kV provincial system, including a 270 km single circuit line and two substations (2 x 1000 MVA); and
- upgrading of the telecommunication and dispatch automation infrastructure to meet new added capacity.

The Hebei Electric Power Company has plans to construct a $1.3 billion Pumped Storage Power Plant in Zhanghewan. The World Bank has disbursed a $310 million loan to China toward the cost of the project. Construction will include a 1000 MW (4 x 250 MW) Pumped Storage Power Plant and one 500 kV transmission line that will connect the power plant to the Hebei south system grid. This will contribute to the rural electrification of 19 counties and one city. The project is estimated to be completed by June 2007.

Many other large hydro projects are planned over the next 30 years including: Xiluodu (14 400 MW), Xiangjiaba (6000 MW), Longtan (4200 MW) and Xiaowan (4200 MW). For additional information on completed and planned hydroelectric power projects, refer to Appendix 2.

Transmission and Distribution Projects

China's power transmission and system operation is going through an extensive national construction and restructuring program parallel to the country's hydroelectric development. Implementation of a national power grid in China is currently under way. Transmission and distribution projects in China are planned and developed at the central government level. Nevertheless, provincial governments command and control finances, administration and implementation of projects.

China's current five-year-plan details a list of ongoing construction projects until the end of 2000. Notwithstanding, most projects are into China's 10th Five-year Plan. Potential

for Canadian equipment and services suppliers, particularly those that provide transmission and distribution consulting services and supply of specialty equipment, exists for several projects:

In 2003, the preliminary phase of the Three Gorges project will be completed and the Central China, East China and Sichuan Provincial power networks will be interconnected, creating a foundation for a nationally integrated power network. The power network will be fitted with 500 kV trunk lines that will send bulk power from the hydro power station to all three regions. The larger-sized Xiaowan, Longtan and other hydro power stations of the southwest hydro power base will be the source to transmit power to the Guangdong and Guangxi power networks. A thermal power infrastructure will take initial shape around the Shanxi and Shaanxi Provinces and Inner Mongolia and Ningxia Autonomous Regions to transmit power to Beijing, Tianjin, Hebei and Shandong load centres.

The Shanghai Municipal Electric Power Corporation announced in April 2000 that it plans to upgrade its power plants and transmission lines. The corporation is seeking specialized maintenance equipment for power plants, on-line monitoring equipment and large section cables for electricity distribution and circuit breakers.

The East China Power Network is planning to build a nuclear power network in the Yangtze River Delta region to secure power exchange among the provinces. The network will open 220 kV loops providing the structure for an independent operating system.

The Central Power Network is planning to expand the local 500 kV grids in the Edong, Zhen Luo and Chang Tan Zhu area. The Jiangxi Provincial 500 kV grid will be upgraded and reinforced to receive the added power as a result of the expansion.

The Northeast China Power network is planning to strengthen 500 kV trunks from Harbin passing Jilin to Shenyang. The 500 kV network configuration running through three northeastern provinces will be improved by double circuit trunk lines. The North China Power network is also planning to construct reinforced trunks with 500 kV double circuit lines. The project's objective is to increase bulk power transmission by 1.5 million KW from Inner Mongolia and Shanxi Province to load centres in the east in Beijing and Tianjin by 2003.

The Yunnan Provincial Electric Power Corporation received a $147 million loan from the World Bank for the Yunnan Provincial Power Transmission project. The objective of the project is to provide technical assistance to review the feasibility study, engineering design and environmental impact studies for the proposed 610 km of 500 kV and 649 km of 230 kV transmission lines. Goods to be procured for construction will include 500 kV transmission line materials, 100 kV, 220 kV and 500 kV substation equipment including transformers, reactors, circuit breakers, and switches, line protection

equipment and communication equipment such as fibre optic systems. The Yunnan power transmission lines will connect the 1350 MW capacity Dachaoshan hydro power project with load centres in Kunming, the capital of Yunnan. The total cost of the project is $458 million and it is expected to be completed by 2002.

A $370 million loan from the IBRD was approved in March 1998 for the East China (Jiangsu) Power Transmission project. The project includes the development of a 500 kV network and transmission line connection to the Yancheng Power plants (6 x 350 MW) in Shanxi province, which includes:

- 993 km of 500 kV transmission lines: Renzhuang-Huaiyin (230 km); Huaiyin-Jiangdu (134 km); Jiangdu-Wunan (124 km); Huaiyin-Yancheng (120 km); Yancheng-Yangdong (135 km); Yangdong-Doushan (30 km); Doushan-Shipai (60 km); Shipai-Huangdu (50 km); Shipai-Shengpu (60 km); line-redirect (50 km) and major river crossing (3 km);

- five new 500 kV and 220 kV substations and the enlargement of two existing 500 and 220 kV substations with total added capacity of 5500 MVA;

- reinforcement of Nanjing urban transmission system, which includes the construction of two new 220 kV substations at Xiaguan and Daxingong and two new indoor 100 kV substations at Xuanwumen and Shanghalai, erection of 10 km of 220 kV line, and the building of telecommunication and automation facilities at the Nanjing Municipal dispatching centre; and

- management and engineering consulting services, and technical assistance for inter-provincial policies.

As of May 1999, consulting services are being sought to support reform of the accounting and financial management systems for the East China Electric Power Group Corporation. The total value of the project is approximately $1.6 billion and it is estimated to be completed by 2005.

The Sichuan Provincial Power Grid is planning to build a 500 kV network upon completion of the second phase of the Ertan Hydro power station by 2010.

In 1997, a $1 million loan was approved for the North Power Transmission Project. The objective of the project is to provide consulting services and technical assistance to review and upgrade the feasibility study, engineering design, environmental examination and resettlement program for 780 km of 500 kV transmission lines. This will also include the evaluation of the impacts caused by the expansion of existing 500 kV substations and distribution systems. The project is ongoing.

In April 2000, the World Bank announced that China received a loan from the IBRD in the amount of $370 million for the cost of construction of the East China (Jiangsu) Power Transmission project. The China Electric Power Technology Import and Export Corporation is seeking bidders for the supply of the following goods and services:

- energy management and trade;
- management System of East China electrical power grid;
- energy and trade management system of Jiangsu electrical power grid;
- distribution management system of Nanjing City electric supply grid;
- suspension towers and accessories for 500 kV Jiangsu river crossing;
- conductors, OPGW and fittings for 500 kV Jiangsu Yangtze river crossing; and
- insulators and fittings for 500 kV Jiangsu Yangtze river crossing.

In May 2000, China completed a feasibility study on an electrical grid expansion project worth $5.9 billion. The transmission network is intended to carry power from the west to Shanghai. A time schedule has yet to be determined for construction. Once complete, Shaanxi province will build a gas-fired 4800 MW power plant to transfer power to Shanghai.

The Tianshengqiao Hydro power Station to Guangzhou will be interconnected with 500 kV HVAC and HVDC lines. The project will enhance the Southern Interconnected Power Network's power transmission capability and reliability.

In 1999, Chengdu, the capital of Sichuan, began a three-year project to construct 34 substations in the province in order to ensure urban power supply. The city's planning bureau slated sites for 16 substations (110 kV), 10 substations (110 kV and 220 kV) to be built and completed by 2001.

Renewable Energy Projects

In July 1999, China received a $148 million loan from the World Bank for the Renewable Energy Development Project. The project consists of the development of wind farms at Huitingxile, Inner Mongolia (100 MW on site with 1000 MW potential); a wind farm at Zhangbei, Hebei (50 MW on site with 500 MW potential); wind farm at Pingtan, Fujian (120 MW); and small wind farms at Chongming and Nanhui, Shanhai (14 MW). Funding will also be allocated to the PV systems. An estimated 400 000 systems of 10 Mwp of PV will be marketed and sold in Qinghai, Gansu, Inner Mongolia, Xinjiang, Tibet, Western Sichuan and adjacent areas. The project has a five-year implementation period ending in 2004. Funding for the project originated from various sources such as the IBRD, the Global environment facility, SPC and domestic commercial banks. The Hydro Power and New Energy Development Department of the SPC is responsible for coordinating the implementation of the wind farm component. The total value of the project is estimated at $657 million.

Guangdong Province is aggressively developing its wind and tidal power generation facilities. Planned Projects for 2000-2010 are illustrated in Table 5.

Table 5. Planned Projects in Guangdong Province 2000-2010

Project	Capacity
Nan Ao Wind farm phase II	10 MW
Huilai Haiwanshi wind farm phase II	13 MW
Shanwei Zelan wind farm	30 MW
Zhangjiang Luzhou wind farm	20 MW
Yangjiang Hailing wind farm	10 MW
Over 100 villages small wind power	3 MW
Zhuhai Wanshan Island Wave Power project	2 KW
Shanwei Wave power	100 KW
Zhangjiang Tidal power station	200 KW

Source: United States Department of Commerce. *Guangdong Renewable Energy Marke* t, 1999.

The Asian Development Bank (AsDB) is providing a $740,000 loan for a Wind Power Project. China requires technical assistance to promote the development of medium-scale wind farms with a total installed capacity of 86 MW at four established sites. The project is currently in a processing stage and consulting service requirements are yet to be determined.

In March 1998, the World Bank approved two loans totaling $463 million. The first focuses on energy conservation and the second for power transmission and energy efficiency in Eastern China. The China Energy Conservation project aims to achieve a reduction in the growth of carbon dioxide emissions and other pollutants in China. The loan amount will partly contribute to the establishment of pilot demonstration programs for information in energy conservation. The project is ongoing.

China received a $1.4 million loan from the AsDB to produce a Power Rehabilitation and Environment Improvement study. The general procurement notice calls for an international consulting service to provide technical assistance in feasibility studies regarding the rehabilitation of several coal-fired plants in China. The project was listed in January 1999 and is ongoing.

China is undertaking a $1.4 billion Wind Power Development Project in Xinjiang Autonomous Region and in Heilongjiang and Liaoning Provinces. The World Bank has presented a $85 million loan, which is expected to get approval in 2000. The goals of the project are to develop wind-based power generation with the construction of wind farms at Dabancheng in the Xinjiang Autonomous Region (30 MW); at Fujin in

Heilongjiang Province (24 MW); and at Xiwaizi in Liaoning Province (24 MW). Another goal is to provide technical assistance for Barrier Removal and institutional strengthening to encourage wind-based power generation in these provinces. Once approved, the estimated completion date of the project is June 2003.

In 1999, the Canadian Government participated in technology expert meetings related to the Technology Co-operation Agreement Pilot Project (TCAPP) in China. TCAPP is a program involving several international partners that is aimed at assisting countries in drafting and implementing steps to attract investment in clean energy technologies. The TCAPP presence in China is primarily due to an agreement signed between the State Development and Planning Commission and the U.S. Environmental Protection Agency. The agreement underlines the need for improving the following technologies in the renewable energy sector: high-efficiency electric motors, grid-connected wind electric power, efficiency improvements in coal-fired industrial boilers, and cleaner coal technologies for power generation. Future Canadian involvement in the TCAPP will determine market potential for renewable energy equipment and services in these areas.

Thermal Power Projects

In November 1995, China received a $651 million loan from the IBRD for the Henan-Qinbei Thermal Power project worth $1.7 billion. The loan will finance the construction of a coal-based thermal power plant at Qinbei. The project involves the construction of the following components:

- construction of two 600 MW coal-fired thermal power units using modern pollution control technology;
- erecting two 165 km 500 kV transmission lines to link the power plant to the existing power network;
- providing consulting, engineering and procurement services; and
- providing technical assistance for the implementation of a power sector reform plan as well as a training program for operations and management of the power system.

The Henan project is currently listed as ongoing.

In October 1998, China completed negotiations for a $660 million loan for the Anhui Puyang Thermal Power plant. A 2x 600 MW supercritical coal-fired power plant at Fuyang is planned by the Anhui Hengyuan Power Generation Co. Ltd. Also included is the construction of access roads, railway extension, water intakes and pipelines, hydraulic ash transportation pipeline and ash disposal yard, and four 4.5 km 220 kV

transmission circuits to Fudong. The loan will also finance a transmission reinforcement project, a rural electrification program, environmental mitigation project and an institutional strengthening program for the Anhui Electric Power Corporation.

A $1.9 billion project is planned in the Inner Mongolia Autonomous region. In May 1997, a $553 million loan from the IBRD was approved for the Tuoketuo Power Project. A 2 x 600 MW coal-fired unit at Tuoketuo Mine Mouth Power Plant in Inner Mongolia is planned for construction by the North China Electric Power Group Inc (NCEPG). The initial capacity of the stations is 1200 MW (2 x 600 MW) and will increase to 3600 MW (2 x 600 MW). The units are expected to come into operation by the end of 2002. In addition, a transmission and distribution network will be built to improve power supply to Beijing. This stage will comprise the following components:

- building of two 220 kV indoor substations at Xibianmen (two 220/110/10 kV transformers) and Xizhimen (two 200 MVA, 220/110/10 kV transformers) respectively;
- construction of a third 220/110/10 kV transformer in the underground Wangfujing substation, which is currently under construction;
- Replacement of overloaded and ineffective units in the Beicheng and Huichengmen substations by four 50 MVA 110/10 kV transformers; and
- technical assistance for the development of the financial management system and the regional power pooling system of the NCEPG.

The loan will finance technical assistance and consulting services to the Inner Mongolia Power Company.

China received a $444 million loan from the IBRD for the Hunan Power Development Project worth $1.1 billion. The construction will consist of two 300 MW anthracite-fired units at the Leiyang Power Plant, reinforcement of the existing 220 kV transmission systems, the supply and installation of 794 km of 220 kV lines and 1920 MVA of transformer capacity, technical services for construction management of the Leiyang Power Plant phase II, and technical assistance for the Hunan Provincial Power Company restructuring plan and their financial management system. The project is being funded by various sources and is ongoing.

In July 2000 the central government announced that it will begin construction of the second phase of the (2 x 300 MW) Anshun Power Plant in Guizhou Province. The $4.7 billion power plant will include the additional construction of coal and water resources, ash-handling areas, desulphurization and transportation equipment.

China's Ningxia Hui Autonomous Region plans to build a No 2 Shizuishan Thermal Power Plant in 2000. The plant will have a combined capacity of 120 kW and will be located in the desert area near the bank of the Yellow River in Shizuishan city.

China received a $591 million loan from the IBRD for the Waigaoqiao Thermal Power project in Shanghai. The project includes the construction of 2 x 900 MW coal-fired super-critical thermal units, installation of a desulphurization device, and support for reform and restructuring of Shanghai Municipal Power Electric Company. The power plant is expected to be completed by 2004.

Yunnan Province is planning to construct a 300 MW thermal power plant in Kaiyuan. The feasibility study is complete and the plant will begin construction in 2002 and go into operation in 2004. According to SPC standards, the plant will have to be fitted with circular float bed boilers for coal desulphurization processing.

Yunnan Province is planning the construction of the second phase of the Qujing thermal power plant project. The plant has a designed capacity of 4 x 300 MW. Two of the four plants have been completed in phase one. Phase two calls for an additional 2 x 300 MW plant, which will be built in 2003.

China received a loan from the IBRD for the installation costs of two sets of limestone-gypsum flue gas desulphurization system for 2 x 300 MW units on the Shanghai Shidongkou Thermal power plant. Shanghai is proceeding with the construction of two power generating units of the Waigaoqiao power plant in Pudong, Shanghai. It is scheduled for completion by 2005.

In June 2000, the China State Council approved the feasibility study for the Henan Qinbei thermal power plant. The project is located in central Henan Province and requires an investment of $44 million. The plant will have a designed capacity of 1.2 million kW, in which there are two 600,000 kW localized supercritical coal-fueled generating units. There is currently no time schedule for construction.

The Shandong China Power Corporation (SCPC) started construction on the Liaocheng Power and Heze power projects in December 1998. The SCPC is currently building 4 x 300 MW units at the Liaocheng plant and 2 x 300 MW units at the Heze power plant, with total installed capacity of 3,000 MW. This project, worth $2.9 billion, is the largest Sino-foreign investment in the thermal power industry in China. The expansion plan of Heze will be completed in 2001 and the newly built 2 x 600 MW units at Liaocheng will be completed in 2002 and 2003 respectively.

The Anshan New Thermo-Electricity Material Corp., a Chinese power utility, is planning to build a thermal power station worth $20.7 million in Liaoning Province.

For additional information on thermal power projects that are currently under construction or planned for the future, refer to Appendix 3 and 4.

Nuclear Power Projects

The Tianwan Nuclear Power Plant located in the city of Lianyungang in Jiangsu Province, is the most recent nuclear power plant under construction in China. The first phase of the construction will cost $4.7 billion, which includes a $1.9 billion loan from the Russian government, $600 million from the China Development Bank, and the remainder provided by shareholders. It is expected to be operational in 2005.

Guangdong province announced in January 2000 that it plans to build a third nuclear power plant near the city of Yangjiang. The plant will be equipped with six generating units, each with a capacity of over 1 million kW. The project will be implemented in three phases. Construction of the first two units will start in 2002 and finish by 2008 and 2009 respectively, while the other four are expected to be operational by 2015.

For a list of current nuclear power projects, please refer to Table 4.

State Power Corporation Project

China has received a $1 billion loan for the SPC's Corporate Development Strategy Project. A fact-finding mission was completed in July 2000, and the ADB announced that consulting services and technical assistance are being sought for the project. The objective of the technical assistance for project planning and preparation is as follows:

- aid the SPC in developing a corporate development strategy in planning, investing, and managing inter-regional transmission interconnections;
- provide workshops, seminars and training to assist the SPC in power management and regulation of the transmission and distribution sector for the infrastructure development in the western regions;
- remove barriers of regional interconnections; and
- develop policy framework to govern interconnections; and
- develop an investment plan and an implementation timetable designed to focus on key issues of interconnections.

The project was first listed by the ADB in May 2000 and is ongoing.

The following details an overview of the SPC's planned development for the 2000-2015 period:

Table 6. The SPC Construction Forecast 2000-2010

Item		Capacity
Planned New Commission		70-75 GW
Planned Termination		30 GW
Start Construction		75-95 GW
Power Generation in 2005		1614 TWh
Average Annual Growth Rate (%)		5%
Total Installed Capacity:		
	By 2005	350-355 GW
	By 2010	436 GW
	By 2015	540 GW
By 2015		Complete an Integrated Power Grid with the Three Gorges Hydro power as the centre
		Optimizing the Power Market

Source: *China Energy Market Series*. "Department of Strategic Planning and Study of the State Power Corporation." February 2000.

Canadian companies seeking additional information on projects funded by the World Bank and other IFIs can access the World Bank Internet site (http://www.worldbank.org/html).

COMPETITIVE ENVIRONMENT

Local Capabilities

China's local production capacity for conventional power sector equipment is strong, with intense competition among domestic Chinese and joint venture enterprises. Consequently, the Chinese government has placed a high priority on local sourcing and new advanced technology. The majority of primary manufacturing centres are located in the northeast cities of Shenyang and Harbin, Shanghai and in Northwest China in Xian.

In 1997, the central government established the China Electrical Equipment Industrial Association (CEEIA). This organization was formed through the amalgamation of six former associations in power generation equipment, transmission equipment, electric machinery, apparatus, electrochemical material and industrial boilers. The CEEIA, has a combined gross output of 4% of China's overall value for gross industrial output. Furthermore, annual output of Chinese power-related equipment yields a total of 150 000 MW a year representing 20% of the world's total output.

International Competition

Since 1994, a number of multinational corporations have established electrical manufacturing centres through joint-ventures enterprises. Siemens, ABB, Alstrom, Westinghouse and others have developed a firm presence in the electrical power market and have been the most active in the DC transmission segment of the industry. International companies from the United States, Germany, Japan, France, Russia, the Netherlands, South Korea, Sweden, Eastern Europe, Austria and Canada are involved in the electrical power equipment and services.

With respect to developing power projects and supplying equipment and technology, major foreign competitors in China's electric power sector are from the United States, Japan and several European countries.

Canadian Position

With respect to power generation, Canadian companies are strong in the design and manufacture of nuclear, gas, steam and hydro turbines and electric generators, as well as the development of fuel-cell technology and hydrogen-making equipment. Canadian companies also have expertise in manufacturing transmission and distribution equipment such as transformers, switch gears, wires and cables.

The Canadian electrical generating equipment sector has relied mainly on successes in markets outside the western hemisphere. A good example is the sale of four CANDU nuclear reactors to China and South Korea. In China, the Geheyan Project (1,280 MW) was constructed by a Canadian consortium, and GE has supplied turbines and generators to the Ertan Project (3,300 MW). GE has also recently received a large contract to provide turbines and generators to the Three Gorges project. Among other notable Canadian companies currently active in the Chinese power sector market, are Babcock & Wilcox, Agra Monenco Ltd., SNC-Lavalin Power, SNC-Lavalin Engineering, CAE Electronics, Hydro Quebec, B.C. Hydro, Acres, ATS Automation, AECL, Timberland Equipment Ltd, Tecsult, Pauwel's Canada Inc., RTDS Technologies Inc, Dessau-Soprin, Roctest Ltd, ComLink Group, Westcoast Energy, Manitoba Hydro, ABB Canada Inc., InterCoastal System Engineering Corporation and others.

Competitive Advantage through Canadian Government Policies and Initiatives

Electrical Trade Virtual Network

The Electrical Trade Virtual Network is composed of groups who are interested in promoting the health and success of Canada's electric power equipment and services sector. namely private sector firms, utilities, associations, appropriate federal government departments (e.g. Industry Canada, Department of Foreign Affairs and International Trade, Natural Resources Canada), and provincial governments Private-

sector membership is restricted to Canadian companies operating in the electric power equipment and services sector. Member companies have access to various sources of market intelligence, including foreign market studies and bidding opportunities, as they become available from the government and especially Canada's Trade Commissioner's working in foreign markets.

National Electricity Roundtable

The National Electricity Roundtable (Canada) provides a focal point for the electrical power sector whereby members at the Chief Executive Officer level can bring national issues affecting the industry before key federal ministers. Membership is representative of the electric power industry and includes major utilities, equipment manufacturers and consulting engineering firms, together with DFAIT, Natural Resources Canada and Industry Canada. In co-operation with the Alliance of Manufacturers and Exporters Canada and the Trade Team Canada Secretariat for Electrical Power Equipment and Services, the National Electricity Roundtable assists in the organization of export-promotion activities for the industry.
http://napoleon.ic.gc.ca/ttcelectrical

Canadian Commercial Corporation

The Canadian Commercial Corporation (CCC) gives Canadian companies access to financing and better payment terms under the Progress Payment Program (PPP). The PPP concept was developed as a partnership between major Canadian financial institutions and the CCC. It enables the exporter's bank to open a project line of credit for the exporter's benefit, based on CCC approval of the project and the exporter's ability to perform. The CCC will also act as a prime contractor on behalf of Canadian small and medium-sized enterprises (SMEs), giving those businesses increased credibility and competitive advantage.

Export Development Corporation

Export Development Corporation (EDC) is Canada's official export credit agency, facilitating Canadian trade with over 200 world markets. EDC's first transaction with China took place in 1980 and since this time EDC customers -- Canadian companies of all sizes -- have concluded over $5 billion of business in China. A variety of EDC trade finance services have been employed in the China market. Financing is traditionally offered on a case-by-case through lines of credit established with select Chinese banks. Export financing may also be considered via direct buyer loans to creditworthy companies which have Chinese government authority to borrow funds abroad. In addition, EDC export and investment insurance programs provide exporters with protection against a variety of risk, both commercial and political. Performance security and contract bonding programs also help exporters by providing exporters with the ability to free up working capital while meeting bonding requirements during the

execution of commercial contracts.

Program for Export Market Development

The Program for Export Market Development (PEMD) helps Canadian companies enter new markets by sharing the costs of activities that companies normally could not or would not undertake alone, thereby reducing risks involved in entering a foreign market. Eligible costs and activities include market visits, trade fairs, incoming buyers, product testing for market certification, legal fees for international marketing agreements, transportation costs of offshore company trainees, product demonstration costs, promotional materials, and other costs necessary to execute a market development plan. Activity costs are shared on a pre-approved, 50/50 basis.

The PEMD refundable contribution ranges from $5,000 to a maximum of $50,000. Preference is given to companies with fewer than 100 employees for a firm in the manufacturing sector and 50 in the service industry, or with annual sales between $250,000 and $10 million. Other components of the program include international bid preparation (Capital Project Bidding) and, for trade associations, developing international marketing activities for their membership. For additional information visit http://www.infoexport.gc.ca/pemd-e.asp or call 1-888-811-1119.

WIN Exports

WIN Exports, a database of Canadian exporters and their capabilities, is used by trade commissioners around the world and by Team Canada Inc partners in Canada to match Canadian suppliers with foreign business leads, and to share information on trade events. To register your company in WIN Exports or for more information, visit http://www.infoexport.gc.ca/winexports/menu-e.asp or call 1-888-811-1119.

PRIVATE-SECTOR CUSTOMERS

China is still in the process of transition to a market economy. The vast majority of utilities in China are Chinese state-owned. There are foreign-invested plants, but their role in China is still quite marginal. While pending WTO accession will eventually result in a wider array of privately-owned import channels, all major import-export agencies are subject to the Chinese government (see appendix for list).

PUBLIC-SECTOR CUSTOMERS

Government Organizations

Electric power generation and transmission projects are managed and approved by several organizations.

- The SPC is the chief implementing body for the majority of power-related decisions made by the central government. One of SPC's recent regulations was the restrictions they enforce against the importation of foreign manufactured equipment used in conventional coal-fired power plants of 600 MW and under. This marketing strategy reflects China's willingness to protect domestic electrical power equipment manufacturers from foreign competition. The SPC has two administrative organizations: The China Power International Ltd., and The China Power Technology Import and Export Company.

- The China Electric Power Technology Import and Export Corporation is a state-owned enterprise established under the certification of the State Council, the Foreign Trade and Economic Co-operation, and the State Administration for Industry and Commerce. Its business operations involve international competitive tendering/procurement and the development of international trade. It conducts business with importers of power equipment and it oversees the planning, design and construction for oversees engineering projects.

- China Power International Ltd., is responsible for exploiting international markets and acquiring funds for power projects.

- The State Development and Planning Commission (SDPC) is a Chinese central agency with significant powers to approve or influence planning of major power projects. It has a profound influence over China's energy utilization policies. The SDPC approves foreign investments in designated sectors, involving foreign equity of over $U.S. 30 million, as well as imports of equipment using foreign funding. The SDPC's role and influence in these matters is difficult to overestimate. Its responsibilities also include strategic planning and infrastructure development in China. The Department of Foreign Capital Utilization, an office within the SDPC, handles all financing for infrastructure projects.

- The State Economic Trade Commission (SETC) regulates and monitors the power industry in China. The ministry has minimal bearing on foreign firms conducting business in the sector. The majority of the ministry's leadership is made up of former members of the Ministry of Electric Power.

- The China Atomic Energy Authority (CAEA) is a government agency responsible for long term planning of nuclear power development reflecting the needs of the national electricity and nuclear industry.

- The National Nuclear Safety Administration (NNSA) is the Chinese regulatory agency, reporting to the State Environmental Protection Agency, responsible for licensing and monitoring nuclear power equipment and related supplies.

- The China National Nuclear Corporation (CNNC) is divided into two groups. The first, named the China National Nuclear Group, supervises and coordinates the mining of uranium, nuclear fuel supply, isotopes, manufacturing for nuclear waste treatment as well as manufacturing for civilian and military use. The second, China National Nuclear Station Construction Group is responsible for constructing nuclear power plants.

Government Procurement Regulations

In January 2000, the Chinese government enacted a new national construction tendering law for foreign bidders. The law administers project procurement activities and minimizes corruption. Key points of the tendering law include the following:

- Open and selective competitive bidding is mandatory for awarding infrastructure and other projects partly or wholly funded by foreign funds.

- Foreign developers/contractors seeking to participate in projects must first receive project-oriented prequalification, while foreign contractors must obtain a qualification certificate that is valid for five years.

- Qualified foreign developers/contractors are permitted to compete for projects financed wholly and partially by foreigners. For locally financed projects, however, foreigners can only bid in the form of a joint venture with local enterprises.

BOT and JV Approval Policies

Foreign investors wishing to establish projects in China through structures such as build-operate-transfer (BOT) agreements should be aware that the regimes currently in place have long been described as inadequate by foreign investors. Plans to replace them with more comprehensive policies, reflecting international standards, have long been anticipated but there are currently few indications that they will be realized soon. The Government of China has, in fact, ceased encouraging BOT projects in the power sector.

Although the process is often long, tortuous and full of surprises, officially at least, foreign investors seeking to engage in joint-venture agreements or wish to participate in a project with mixed foreign and domestic investment must adhere to the following requirements:

- legally put into effect a joint-venture contract approved by the Ministry of Foreign Trade and Economic Co-operation;
- produce a pre-proposal to the SDPC detailing the foreign investment structure;
- have a memorandum of understanding (MOU) outlining the total foreign and domestic investment, sources of financing, length of the joint venture and any currency risks implied;
- produce and finalize a detailed feasibility study, which includes total investment, security for the investment, reliance on foreign exchange and approximate investment return; and
- wholly foreign-invested plants will be required to provide a second detailed feasibility study and get approval from the SDPC.

The majority of power transmission and distribution networks are owned and operated by regional power groups or provincial power companies. The central bureaus in Beijing regulate the power groups through a decree entitled *Regulation of Power System Dispatching*. This organization is responsible for approval and funding procedures for refurbishment and repairs of provincial networks as well as projects under construction. This is currently the case with Three Gorges Project. Canadian companies seeking competitive advantage in the transmission and distribution segment can contact this company directly with regards to information on bids for the Three Gorges Project.

Exporters seeking sales opportunities in the Guangdong renewable energy equipment and technologies market should contact the Guangdong Provincial Planning Commission. This company acts as the sole end user, owner, and bid-evaluator for non-conventional electricity generating equipment and is responsible for the approval of all new plans within the province. The Guangdong power industry is less controlled by the central government in regard to power equipment procurement.

The SDPC publishes a monthly list of state-level key construction projects focusing on the electrical power and transportation sector. Information on key development projects is available through the Internet (http://ccpit.org/engVersion/cp_infor/projects.html).

MARKET LOGISTICS

Channels of Distribution

Channels of distribution are rapidly changing in China, bolstered further by pending WTO accession. China is a highly regionalised market, and in some circumstances companies are advised to develop regional-specific market entry strategies.

Canadian companies are advised to contact the Canadian Embassy in Beijing, the Consulates General of Canada in Guangzhou and Shanghai, or the Consulate in Chongqing for a list of reliable and authorized equipment manufacturers and suppliers, service providers, technology distributors and agents in their respective regions.

Canadian firms seeking to enter the Chinese market should also consult market access reports from Industry Canada's Strategis Internet site at http://strategis.ic.gc.ca , which describe in further detail all potential channels of distribution in China.

Direct Sales

Direct marketing by foreign firms, while permitted, is not generally recommended in China. Foreign suppliers seeking to access the Chinese marketplace should consider doing so through an agent or distributor; consider joint-venture arrangements with Chinese partners, or locally established, wholly owned ventures. In China, common market entry partners involve regional or national utilities (under the framework of the State Power Corporation), the half dozen or so national Electric Power Import-Export Corporations, as well as various research institutes which are rapidly transforming into market-driven enterprises (see appendix list). Once again, this situation is in flux and sales and marketing strategies should be carefully tailored to the product or service in question. It is highly advisable to work with Canadian Trade Commissioners based in China.

Market-entry Considerations

Although the rapidly developing Chinese economy offers clear opportunities to foreign suppliers in a variety of sectors, Canadian exporters should be aware that a number of challenges to market access remain. The Chinese business environment is quite aptly characterized as complex and variable. Frequent policy changes, strong domestic protection, challenges in enforcement of intellectual property laws, low profit margins, and inefficient channels of distribution are common complaints of foreign companies operating in the market. The government-led restructuring currently being undertaken in most sectors is contributing to the complexity of China's trade system.

Analysts predict a gradual growth, on a national basis, in Chinese demands for new electric power sources. Accelerating demands for power are materializing in the

southern and coastal regions, and they are expected to grow unabated for the foreseeable future. With regard to new projects, the emphasis will be placed on improving efficiencies and expanding and improving transmission and distribution systems. An exception is China's continued planning of multi-functional projects, including on a large scale (ie in the category of Three Gorges, Xiaolangdi and Zipingpu). Moreover, the government is promoting further investment and enhancement of the national power grid system. This is primarily focused, in the short term, on the transnational interconnection of the Three Gorges Hydroelectric project. Given the increase in the number of new hydroelectric power plants, China will place a top priority in flood-prevention projects. Environmental technologies will also be in high demand as the country undertakes to reduce pollution problems.

Following the political changes in the power sector, provincial governments and organizations are being called on to take a more proactive role in the development and financing of power projects, although approvals from central levels will still be required for larger projects (over $44 million). Financing for these projects continues to pose a challenge. Although IFIs have been a major source of funding for the sector in the past, their involvement is decreasing.

At present, the Chinese government has placed a high priority on the implementation of new regulations aimed at encouraging domestic production of power equipment and raw materials by local manufacturers. This could put added pressure on Canadian companies to localize segments of their manufacturing operations. The SPC's restrictions on imports of select power generation equipment have delayed the growth in the nuclear power market and slowed the introduction of more modern, environmentally friendly technologies.

However, domestic production of power equipment is increasingly encouraged in the transmission and distribution equipment market. China has placed a number of restrictions on imports of equipment for the alternating current (AC) sector while continuing to promote domestic equipment in the DC sector.

Canada has long made a contribution to the development of China's power sector. Joint-venture agreements between Canadian power equipment manufacturers and their Chinese counterparts have proven to be successful in the past. Over the past 30 years, China has been engaged in more than 500 joint-venture agreements in the electrical power equipment manufacturing sector. Foreign firms involved in joint-venture enterprises are viewed as domestic companies, which enables them to compete in areas closed to other foreign firms.

Exporters should be aware that the Chinese project financing market is experiencing a number of changes. The current reorganization may cause confusion, delays and frustration among investors. However, in the long term, these changes will make the system more predictable and will introduce a wider range of financing opportunities for

Canadian businesses. Recent regulatory developments in China have been slow. However, the Government is now placing significant emphasis on the development of new regulations governing power pricing and rules for accessing the power market. Long awaited new guidelines for BOT projects appear to have been de-emphasized in line with weaker government support of new generation capacity.

Elsewhere in the sector, in view of unreliable supply, one of the fastest-growing segments of the Chinese power-generating market is that of back-up and reserve systems for large buildings, factories and industrial parks. These systems make up nearly one third of new power-generating capacity in some parts of China.

China's Accession to the World Trade Organization

China has made a number of trade-related commitments to the WTO members that are expected to take effect when China accedes to the organization. These include tariff concessions as well as commitments to apply WTO rules relating to subsidies, standards, intellectual property, import licensing, trade-related investment measures and sanitary and phytosanitary measures. China will also be bound by fundamental WTO principles that will require the country to strengthen commercial legal procedures and improve transparency.

China's WTO commitments should help to reduce the risk of doing business in China and encourage increased trade and investment flows. However, most commitments will be phased in over time. In the case of lower tariff rates, most new bound rates will be phased in over five equal, annual increments from the date of accession.

China negotiated a number of tariff rate concessions in its bilateral WTO agreements with member countries. The most favourable concession for any item will apply to all member countries once China joins the WTO. On November 26, 1999, Canada and China concluded a bilateral agreement providing for improved market access for a range of goods and services.

Suggested Business Practices

Most business in China is conducted through personal contacts. Frequent visits to the Chinese market exporters— and/or establishment of a local office — is advisable for establishing successful, long-term business relationships in China.

Due to the nature of the energy sector, and the size and time frame of certain projects, it is common for suppliers to operate in a selected province through local representative offices, authorized distribution companies or both. A joint-venture partnership with a company is viewed by the end user as a strong and long-term commitment to the industry.

Many Canadian companies have established a local representative office in China in order to position themselves for long-term business activity. Careful selection of location, attention to staffing issues, cultivation of relationships and potential partners are among the keys to success.

All training and usage documentation accompanying imported products must be provided in the local language.

Proper respect should be shown to potential clients or other business partners by addressing them by their title (e.g. Mr., Dr.), and by being on time for all meetings. Also as a sign of respect when exchanging business cards, Canadians should give adequate consideration to the business card presented.

Investment projects require approval at levels that vary according to size, industrial sector and location. Canadian firms with investment interests should study all aspects of a prospective investment carefully and obtain a clear understanding of the details of Chinese investment policy and applicable laws.

Import Regulations

Although China has made impressive strides in reducing import tariffs and liberalizing restrictions previously imposed on foreign trade, non-tariff import barriers remain a challenge to foreign exporters. Only government-authorized companies may sign trade contracts, just as domestic agents, alone, are permitted to arrange for the importation of a product into China. Involvement in a joint venture or similar partnership with a domestic firm can help ease navigation through import regulations.

All imported electrical power equipment is required to meet Chinese national standards. The SPC, the China Grid Development Company, and Provincial and Individual Power companies are the main access organizations for sales of equipment and services to the sector. The central government has begun to reform its controlled trade regime to advance its case for membership in the WTO.

Required documentation for imported products include the following:

- bill of lading;
- commercial invoice;
- shipping list;
- import quota certificate for general commodities;
- sales contract;
- insurance policy;
- customs declaration form;
- operating instructions;
- authorization for sale certificate from the country or region of manufacture;

- a manufacturer's written guarantee regarding the product's quality, including; specification and standards of quality; and information/documentation on the importer (e.g. distributor, agent).

There is a 17% value-added-tax on imported items collected by the Customs General Administration. Their office has a comprehensive guide containing tariff schedule and national customs regulations. It can be obtained from:

Xing Sheng Zhong Hai Fa Xing Zhong Xing Company
#6 JianNei DaJie
Dong Cheng Qu
Beijing 100730 China
Tel.: (86-10) 6519-5923
Fax: (86-10) 6519-5616

Usually, the Chinese importer (or local agent/distributor/joint-venture partner) is responsible, with the co-operation of the foreign exporter, for handling the documentation requirements.

Local Standards, Certificates or Registrations

The State Bureau of Quality and Technical Supervision is responsible for formulating national standards for domestic (Chinese products), issuing required quality certificates, and enforcement of regulations and policies.

The State Administration for the Inspection of Imported and Exported Commodities is responsible for the quality control of imported and exported goods in China. China is in the process of adopting international standards, so Canadian products fulfilling Canadian or equivalent certified quality standards are generally in compliance with Chinese requirements. Relatively few imported electrical products need to pass the technical examination in the Quality and Technical Test Centre which is under the direct administration of State Bureau of Quality and Technical Supervision.

The issue of bifurcated inspection agencies of imported and domestic products is currently under review in the context of China's WTO accession. Therefore, the duties and responsibilities of Chinese standards agencies may change in due course.

Export Credit Risks, Restrictions on Letters of Credit or Currency Controls

Chinese agents and distributors are generally well-versed in the use of letters of credit and other common export financing mechanisms. Foreign companies doing business in China have also found that both public- and private-sector customers generally observe contract requirements with regard to issuing payment on time and according to the specifications of the agreement. Generally, the method of payment is a matter for negotiation between the individual supplier and importer. The usual practice is for

payment to be made by a letter of credit payable within 30 or 60 days. In cases in which distribution arrangements are concluded, exporters are advised to prepare a contract detailing all major points of agreement, rights and responsibilities, particularly in situations involving intellectual property, patents and patterns.

All commercial transactions involving foreign exchange payments in China must be approved by the State Administration of Exchange Control.

PROMOTIONAL EVENTS

Event/Description	Organizer
8th International Exhibition on Energy and Power November 7- 10, 2000 EP China Electrical China 2000 2nd International Exhibition on Electrical Engineering, Electrical Equipment and Contractors' Supplies Venue: Beijing Exhibition Center, Beijing	Adsale Exhibition Services Ltd 4/F Stanhope House, 734 King's Road North Point Hong Kong Tel: (852) 2811-8897 Fax: (852) 2516-5024 email: aes@adsaleexh.com website: http://www.adsaleexh.com
4th International Exhibition on Nuclear Power Industry 30 March - April 01, 2001 NUCLEAR 2001 Venue: Shanghaimart, 2299 Yanan Road West Shanghai, PRC	Coastal International Exhibition Co Ltd Rm 3808 China Resources Building 26 Harbour Road Wanchai, HK Tel: (852) 2827-6766 Fax: (852) 2827-6870 email: general@coastal.com.hk website: www.coastal.com.hk
7th International Electric Power Supply Equipment May 29 - June 01, 2001 Expo 2001 Venue: Central China International Centre, Wuhan, PRC	Coastal International Exhibition Co Ltd Rm 3808 China Resources Building 26 Harbour Road Wanchai, HK Tel: (852) 2827-6766 Fax: (852) 2827-6870 email: general@coastal.com.hk website: www.coastal.com.hk
5th International Exhibition for Electrical Transmission, Distribution, Installation and Engineering Technology Sept. 4-7, 2001 ELENEX CHINA 2001, Venue: Shanghai	Hong Kong Exhibition Services Ltd Tel: (852)2804-1500 Fax: (852)2528-3103

KEY CONTACTS AND SUPPORT SERVICES

Canadian Government Contacts

Canadian Embassy and Consulates

Canadian Embassy – Beijing
19 Dongzhimenwai Dajie
Chaoyang District
Beijing 100600 China
Tel.: (86-10) 6532-3536
Fax: (86-10) 6532-4072
E-mail: bejing-td@dfait-maeci.gc.ca

Canadian Consulate – Chongqing
Metropolitan Tower, Suite 1705
Wu Yi Lu, Yu Zhong District
Chongqing 400010 China
Tel.: (86-23) 6373-8007
Fax: (86-23) 6373-8026
E-mail: cdncon@public.cta.cq.cn

Consulate General of Canada – Guangzhou
China Hotel Office Tower, Suite 801
Liu Hua Lu
Guangzhou 510015 China
Tel.: (86-20) 8666-0569
Fax: (86-20) 8667-2401
E-mail: gzconcan@public.guangzhou.gd.cn

Consulate General of Canada – Shanghai
Tower 4, Suite 604
Shanghai Centre
1376 Nanjing Xi Lu
Shanghai 200040 China
Tel.: (86-21) 6279-8400
Fax: (86-21) 6279-8401
E-mail: shngi@dfait-maeci.gc.ca

Consulate General of Canada – Hong Kong
13 Floor, Tower One
Exchange Square
8 Connaught Place
P.O. Box 11142
Central, Hong Kong
Tel.: (852) 2847-7414
Fax: (852) 2847-7441
Internet: http://www.canada.org.cn

Department of Foreign Affairs and International Trade (DFAIT)
125 Sussex Dr.
Ottawa, ON K1A 0G2
Internet: http://www.dfait-maeci.gc.ca

China and Mongolia Division
Lester B. Pearson Building (A5)
125 Sussex Drive
Ottawa, ON K1A 0G2
Tel.: (613) 996-0905
Fax: (613) 943-1068
Contact: Su Yun Myong
E-mail: suyun.myong@dfait-maeci.gc.ca

Market Support Division (TCM)
Tel.: (613) 944-0117
Fax: (613) 944-0050
Contact: Ken Cumming
E-mail: kenneth.cumming@dfait-maeci.gc.ca

Canadian Commercial Corporation (CCC)
50 O'Connor St., Suite 1100
Ottawa, ON K1A 0S6
Tel.: 1-800-748-8191 or (613) 996-0034
Fax: (613) 995-2121
Internet: http://www.ccc.ca

Canadian International Development Agency (CIDA)
Industrial Co-operation Division (CIDA-INC)
Place du Centre, 5th Floor
200 Promenade du Portage
Hull, QC K1A 0G4
Tel.: (613) 997-0563
Fax: (613) 953-5024
E-mail: info@acdi-cida.gc.ca
Internet: http://www.acdi-cida.gc.ca

Canada Business Service Centres
Tel.:1-888-811-1119
Internet: http://www.cbsc.org

Canada China Business Council
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180 Dundas St. West, Suite 1502
Toronto, ON M5G 1Z8
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Internet: http://www.ccbc.com

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Tel.: (011-86-10) 6512-6120 or (011-86-10) 6500-2255, ext. 1820/1821/1822
Fax: (011-86-10) 6512-6125
E-mail: ccbc@chinaonline.com.cn.net

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South Tower, Hong Kong Plaza
283 Huai Hai Zhong Rd., Room 1901
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E-mail: ccbcsh@online.sh.com

Western Canada Office
515 West Hastings St., Suite 2600
SFU at Harbour Centre
Vancouver, BC V6B 5K3
Tel.: (604) 291-5190
Fax: (604) 291-5039
E-mail: alison_winters@sfu.ca

The Canadian Chamber of Commerce in Hong Kong
Executive Director
10/F Kinwick Centre, Suite 1003
32 Hollywood Rd.
Central, Hong Kong
Tel.: (852) 2110-8700
Fax: (852) 2110-8701
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Export Development Corporation (EDC)
151 O'Connor St.
Ottawa, ON K2P 2L8
Tel.: 1-800-850-9626
Fax: (613) 598-6697
E-mail: export@edc4.edc.ca
Internet: http://www.edc.ca

Industry Canada
Manufacturing and Processing Technologies Branch
235 Queen St.
Ottawa, ON K1A 0G2
Tel.: (613) 954-5446
Fax: (613) 941-2463
Contact: Stuart Fee
E-mail: fee.stuart@ic.gc.ca

Canadian Industry and Professional Associations

Alliance of Manufacturers & Exporters Canada
National Office
75 International Blvd., Suite 400
Toronto, ON M9W 6L9
Tel.: (416) 798-8000
Fax: (416) 798-8050
E-mail: icbc@the-alliance.com
Internet: http://www.the-alliance.com

Canadian Chamber of Commerce
Delta Office Tower
350 Sparks St.
Ottawa, ON K1R 7S8
Tel.: (613) 238-4000
Fax: (613) 238-7643
E-mail: info@chamber.ca
Internet: http://www.chamber.ca

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Embassy of the People's Republic of China
515 St. Patrick St.
Ottawa ON K1N 5H3
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Fax: (613) 789-1911
Internet: http://www.chinaembassy-canada.org

In Calgary
1011 - 6 Ave. SW, Suite 100
Calgary AB T2P 0W1
Tel.: (403) 264-3322
Fax: (403) 264-6656

In Toronto
240 St. George St.
Toronto ON M5R 2P4
Tel.: (416) 964-7260
Fax: (416) 324-6468

In Vancouver
3380 Granville St.
Vancouver BC V6H 3K3
Tel.: (604) 734-7492
Fax: (604) 737-0154

China Council for the Promotion of International Trade (CCPIT)/China Chamber of International Commerce (CCOIC)
1 Fuxingmenwai St.
Beijing 100860 China
Tel.: (86-10) 6801-3344 or 6803-4830
Fax: (86-10) 6803-0747 or 6801-1370
Contact: Shen Xuejing or Yang Mei
E-mail: ccpitweb@public.bta.net.cn
Internet: http://www.ccpit.org

Guangdong Provincial Planning Commission
Renewable Energy Division
Tel.: (86-20) 8313-3150
Fax: (86-20) 8334-4483
Foreign Economic Relations Department
Tel.: (86-20) 8778-0584
Fax: (86-20) 8777-8114

Ministry of Water Resources
No. 2, Lane 2
Baiguang Lu
Beijing China 100053
Phone : (86-10) 6320-2697
Fax : (86-10) 6354-8037

Ministry of Foreign Trade and Economic Co-operation (MOFTEC)
2 Dong Chang'an Ave.
Beijing 100731 China
Tel.: (86-10) 6519-8818 or 6519-8803
Fax: (86-10) 6519-8904
E-mail: webmaster@moftec.gov.cn
Internet: http://www.moftec.gov.cn

National Nuclear Safety Administration
115, Xizhimennei Nanxiaojie
Beijing China 100035
Phone : (86-10) 6615-3366
Fax : (86-10) 6612-6715

State Adm. of the inspection of Imp&Exp Commodities
A-10, Chaowaidajie
Beijing China 100020
Phone : (86-10) 6599-4600

State Bureau of Quality and Technical Supervision
4, Zhichunlu
Haidian District
Beijing China 100088
Phone : (86-10) 6202-2288

State Customs Administration
6 Jiannei Ave.
Beijing 100730 China
Tel.: (86-10) 519-5244, 519-4114, or 512-6040
Fax: (86-10) 519-4004 or 519-6020

State Development Planning Commission
38 South Yuetan Street
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Beijing China 100824
Phone : (86-10) 6850-2968
Fax : 86-10-850-2728

State Economic and Trade Commission
26 Xi Da Jie
Xuan Wumen
Beijing China 100053
Phone : (86-10) 6319-3569
Fax : (86-10) 6319-3625

Three Gorges Project Construction Committee of State Commission
32 Chegongzhuang
West Road
Beijing China 100044
Phone : (86-10) 6841-5511
Fax : (86-10) 6843-7366

Chinese Industry and Professional Associations

Anhui Electric Power Company
415, Wuhu Road
Hefei, Anhui China 230061
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Beijing Power Supply Bureau
41, Qian Men Xi Da Jie
Beijing China 100031
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China Council for Promotion of International Trade (CCPIT)
1 Fuxingmenwai St.
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China Electric Power Technology Import and Export Corporation
5 Liupukang St.
Xicheng District
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Tel.: (86-10) 6401-5511 Ext. 3555, or (86-10) 6201-1902
Fax: (86-10) 6237-0025

China National Technical Import & Export Corporation (CNTIC)
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BIBLIOGRAPHY

Alexander's Gas and Oil Connections. "Central to add 4300 MW and Power Grid," December 1998.

———. "World Bank finances renewable energy project in China," July 19, 1999.

Asian Development Bank. "AsDB Approves $170 Million Loan and Technical Assistance to the PRC for the Fujian Mianhuatan Hydropower Project," December 14, 1995.

——. "AsDB Approves $200 Million Loan and $422,000 Technical Assistance Grant to People's Republic of China for the Henan Power Project," November 7, 1995

———. "AsDB Backs Pioneering Financing for Power Plant in the PRC," February 26, 1998.

———. "AsDB Transmission Project Helps PRC Shift from Coal to Hydropower," November 27, 1998.

———. "Corporate Development Strategy for SP," May 12, 2000.

———. *Fujian Mianhuatan Hydropower Project* , July 14, 2000.

———. *Hebei Zhanghewan Pumped Storage Plant*, November 1998.

———. *Hunan Lingjintan Hydropower* , March 15, 2000.

———. *Northeast Power Transmission Project* , November 1997.

———. *Pro-Poor Urban Heating Tariff Reform* , August 2, 2000.

———. *Power Rehabilitation and Environment Improvement* , December 7, 1998.

———. "Preparing a Coalbed Methane Demonstration Project," December 7, 1998.

———. *Rural Electricity Supply Study* , July 7, 1999.

———. *Shen-Da Power Transmission and Grid Rehabilitatio* n, October 15, 1998.

———. "US$ 150 Million AsDB Loan to Increase Power Transmission Capacity in the PRC," November 25, 1997.

———. *Wind Power Development Project* , August 18, 2000.

———. *Yunnan Dachaoshan Power Transmission* , February 8, 1999.

Asia Intelligence Wire. "China to Double Hydropower Capacity in 15 Years," July 14, 2000.

———. "China: Projects Initiated for Investment," August 15, 2000.

———. "Hydropower: Challenging but Critical," March 22, 2000.

Asia Pulse. "China's Zhejiang to Build Second Phase of Jiaxing Power Plant," December 14, 1999.

———. "China Expects a Profitable Power Sector," March 24, 2000.

———. "China Strengthens International Energy Co-operation," June 8, 2000.

———. "China to Build Four New Hydropower Stations," February 29, 2000.

———. "China Electric power Sector," May 2000.

———. "China Encourages Investors to Build Small Hydropower Stations," July 11, 2000.

———. "China's Power Industry," August 1999.

———. "China Plans Five Hydropower Stations Along Yangtze," March 15, 2000.

———. "China Policy Shift to Cleaner Fuels," February 29, 2000.

———. "China Restructures Power Industry," May 18, 2000.

———. "China to Open 4 More Nuclear power Plants in 2001-2005," July 27, 2000.

———. "China's State Power Corporation to Invest in West to East Transmission," April 28, 2000.

———. "China's Ninghia to build second Shizuishan power plant," December 29, 1999.

———. "China sets 2001-2005 Targets for Power," January 21, 2000.

———. "China Invests in Construction/Upgrading of Power Industry," May 16, 2000.

———. "China, Thailand to Jointly Build New Power Station," June 27, 2000.

———. "China sets 5 Principles for the power Industry in 2001-2005," June 29, 2000.

———. "Guangdong Plans to Build New Nuclear Power Plant," January 25, 2000.

———. "Great Potential for Power Transmission Equipment in China," September 2, 1999.

———. "Profile of China's Coal Industry," August 2000.

———. "Prospects for China's Yunnan Hydropower Bright," January 21, 2000.

———. "Siemens Poised for Role in Giant China Dam Project," August 19, 1999.

———. "Shanghai Building Second Phase of Waigaoqiao power Plant," November 19, 1999.

———. "Southwest China City to Build 34 Substations," August 31, 1999.

———. "World Bank Procurement – China, Thermal Power," October 26, 1999.

———. "World Bank Procurement – China, Power," September 21, 1999.

———. "World Bank Procurement – China, Hubei Hydropower Project," March 14, 2000.

———. "World Bank Procurement - China Jiangsu Power Transmission," March 29, 2000.

———. "World Bank Procurement - China, Thermal Power Project," January 17, 2000.

Canadian Commercial Corporation. *Electrical Power Equipment,* July 2000.

Canadian Embassy, Chongqing. *Report on Energy in Chongqing and Sichuan*, July 2000.

———. Guangdong. *Development Trend in the Electricity Market in South China,* July 2000.

Canadian International Development Agency. *China Energy Project Listing* , July 2000.

China Daily. "China's Coal Industry Faces Increasing Obstacles," April 24, 2000

———. "China – Power Industry Expects More Investment," November 28, 1999.

———. "China – Power Supplies Sought in Western Area," April 16, 2000.

China Online. "China – China's Dam Plan," August 11, 2000.

———. "China to Rely on Less Nuclear Power," March 14, 2000.

China Today. "Guangdong Grand Resources International Investment Co. Ltd, Energy Industry investment Projects," July 25, 2000.

Department of Strategic Study and Planning, the State Power Corporation China. *Electric Power, Industry* China, 1999.

Department of Foreign Affairs and International Trade. *China and Hong Kong Trade Action Plan 2000* , 2000.

Dow Jones. "Beijing Research Institute Donates Solar Devices to Tibetan Farmers," July 20, 2000.

———. "China: Canada Helps with Foreign Investment for Water Resources," April 26, 1998.

———. "China Completes Study on Grid Expansion," April 17, 2000.

———. "China's Economic and Social Development Report for 1999," March 22, 2000.

———. "China: Xiamen Zone to Invest in Power Supply Grid," April 1, 1998.

———. "China Reduces Transmission Support Fees By Half, cutting $600-million Annually," July 3, 2000.

———. "China: Nuclear power plant breaks ground," October 21, 1999.

———. "China: Reform set for power generators, distributors," October 24, 1999.

———. "China: Power Industry expects more investment," November 29, 1999.

———. "Contract Awarded to Hydro-Quebec International in China," June 11, 1999.

———. "Hydro-Quebec Joins PSEG Global and AIF in China; MPC Authorizes $100 Million of New Shares," July 8, 1999.

The Electricity Daily. "Report says China Planning Four New 1000 MW Nukes," November 10, 1999.

Energy China Market Series. "Electric Power," 1999.

International Briefs. "China to Develop Regional Hydro," June 20, 2000.

International Energy Administration. *Key Details About Electrical Power in China*, July 2000.

———. *China*, April 2000.

———. *China: Environmental Issues* , October 1999.

International Financial Institutions - Basic Projects Database. *Management and Tariff for Anhui Fuyang Power Corporation*, May 13, 1999.

International Water and Power Dam Construction . "Hydro-Québec Buys Stake in Chinese Power Company," January 2000.

Modern Power System. "Nuclear Power Progress, Full Speed Ahead for China's First VVER-1000s," February 29, 2000.

———. *Service Contracts - CIDA. Monitoring Systems and Instruments MWR Dams* , July 7, 1997

United States Department of Commerce. *China* – Transmission and Distribution, April 1, 1999.

———. *China – Power Generation Investment and Financing* , March 1, 1999.

———. *China – Hydro-Power Trade Show*, August 6, 1999.

———. *China – Nuclear Power Regulation* , April 30, 1999.

———. *Electric Power Project*, April 4, 2000.

———. *Guangdong Power Generation Equipment*, September 1, 1999.

———. *Large-Scale Project in Guizhou Province*, June 7, 2000.

———. *Power Industry Reajusting Focus* , November 11, 1998.

———. *Renewable Energy*, January 6, 2000.

———. *Renewable Energy Market*, August 1, 1999.

———. *Renewable Energy Industry Development Plan* , January 1, 2000.

———. *Top Ten Infrastructure Projects in Western China*, May 19, 2000.

———. *Thermal Power Equipment*, December 11, 1997.

———. *Yunnan Power Projects* , November 17, 1999.

The Wall Street Journal. "Foreign Power Companies Fear Chinese Reforms Designed to Slice Consumer Electricity Prices," January 28, 2000.

Xinhua General News Service. "More Power Stations to be Built on Upper reaches of Yellow River," April 20, 2000.

———. "China to Launch Massive Hydropower Construction in the 21st Century," May 24, 2000.

———. "China to Complete Beijing-based Nuclear Reactor Next Year," September 17, 1999.

———. "China to Streamline Power Industry," November 18, 1999.

———. "China Accelerates Hydropower Development," May 18, 2000.

———. "China has Huge Potential for Small Hydro-Electric power Projects," June 21, 2000.

———. "China Encourages Investors to Build," July 11, 2000.

———. "Construction at Three Gorges Proceed," May 25, 2000.

———. "Foreign Investment Sought for Project," August 15, 2000.

———. "Henan Qinbei Power Plant Approval," June 7, 2000.

———. "Huzhou Economic and Technological Development," August 7, 2000.

———. "Statistics China Charts Plans for Energy Development," June 15, 2000.

———. "World's Largest Renewable Energy Consumer," May 25, 2000.

World Bank. *China – Ertan II Hydroelectric Project*, June 1995

———. *China –Tuoketuo Thermal Power Station Project*, November 1999.

———. *China – Sichuan Power Transmission Project*, January 20, 1995.

———. *China – Waigaoqiao Thermal Power Project*, March 14, 1997.

———. *China – Energy Conservation Project*, March 1998.

———. *China – East China Jiangsu 500 kV Transmission Project*, May 1998.

———. *China – Hunnan Power Development Project*, June 1998.

———. *China – Renewable Energy Development Project*, March 1999.

———. *China – Tongbai Pumped Storage Project*, November 16, 1999.

———. *China – Beijing Transmission and Distribution Project*, March 1999.

———. *China – Efficient Industrial Boilers*, January 1997.

———. *Report on China's Power Industry*, December 6, 1999.

OTHER REFERENCE MATERIAL

Useful Internet Sites

Canadian International Development Agency (CIDA): **http://www.acdi-cida.gc.ca/europe-e.htm** (Information on CIDA's activities worldwide. Mirror sites in French and English).

Department of Foreign Affairs and International (DFAIT):
http://www.infoexport.gc.ca/section2/market-e.asp (Market research reports, by region or sector. Mirror sites in English and French.)

Export Development Corporation (EDC): **http://www.edc.ca** (Services and information to help Canadian companies do business internationally. Mirror sites in French and English.)

Industry Canada: **http://strategis.ic.gc.ca**

Team Canada Inc. ExportSource: **http://exportsource.gc.ca** (Search tool for export information from Team Canada Inc.).

World Bank: **http://worldbank.org** (Country profiles prepared by the World Bank. In English.)

General Sites

APEC Energy Ministers Conference: **http://www.apecenergy.org**

Asian Development Bank: **http://www.adb.org**

China New Energy: **http://www.newenergy.org.cn** (A good information source for renewable energy in China. Produced by the Energy Institute of Guangzhou of the Chinese Academy of Science and supported by the Ministry of Science and Technology, and State Economic and Trade Commission.)

Energy Information Administration: **http://www.eia.doe.gov**

Global Infrastructure Projects Database: **http://www.foreign-trade.com/usita.HTM**
(Description of each project, the sector, the country, expected award date, and government contact information. Viewable by project, country and industry).

United States Department of Energy: **http://www.doe.gov**

Chinese Sites

Canada's Window on China: **http://www.canada.org.cn**

China Council for the Promotion of International Trade (CCPIT): **http://www.ccpit.org** (Excellent source of info. on regulations, tariffs, business climate, etc.)

China Daily: **http://www.chinadaily.com**

China-Hong Kong Factbook: Business Protocol in China: **http://www.dfait-maeci.gc.ca/china**

Exporting and Investing: SME Survival Guide to the China Market: **http://www.dfait-maeci.gc.ca/china**

ChinaMarket: **http://www.chinamarket.com.cn** (posts tender notices/pre-notices and company information)

ChinaSite: **http://www.chinasite.com** (very comprehensive English-language Chinese Internet portal with links to a wide variety of business sector sites)

China Today: **http://www.chinatoday.com**

China Trading: **http://www.chinatrading.com**

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Appendix 1. China Power Network's Total Installed Capacity

Network and Region	Installed Capacity		Electricity Generation	
	Total (MW)	Hydro (%)	Total (TWh)	Hydro
North China Power Network (NCPN)	34 312.1	15.96	141.15	5.62
Northeast Power Network (NEPN)	37 186.6	5.94	178.93	1.36
East China Power Network (ECPN)	46 121.0	9.62	211.45	5.4
Central China Power Network (CCPN)	40 749.3	30.6	160.37	28.7
Northwest Power Network (NWPN)	19 275.1	36.28	69.6	28.33
Shandong Provincial Grid (SDPG)	17 380.1	0.27	84.06	0.09
Fujian Provincial Grid (FJPG)	8 008.0	58.28	32.19	57.41
Guangdong Provincial Grid (GDPG)	29 027.7	18.99	103.85	14.72
Guangxi Provincial Grid (GXPG)	5 645.0	58.32	22.78	56.94
Chongqing Power Grid	3 157.0	9.93	12.64	9.37
Sichuan Provincial Grid	11 942.3	57.14	44.37	49.94
Yunnan Provincial Grid (YNPG)	5995.6	61.91	24.14	61.26
Guizhou Provincial Grid (GZPG)	4 578.2	37.64	23.58	29.3
Hainan Provincial Grid (HNPG)	1 536.7	34.71	3.67	27.42
Xinjiang Autonomous Region (XJAG)	2 160	2.84	10.64	4.01
Xizang Autonomous Region (XZAG)	159	68.68	0.28	61.92

Source: *Electric Power, Industry in China* . State Power Corporation, 1999.

Appendix 2. Hydropower Stations (1000 MW and above) in China, Completed and Under Construction (U.C)

Name	River	Province or Autonomous Region	Year of Commissioning	Active Storage (Gm)	Dam Type	Dam Height (M)	Design Head	Average Discharge (M/s)	Installed Capacity (Mw X No. of Units)	Annual Output
Baishan	Songhuajiang	Jilin	1983-1991	3.54	AG	149.5	110	239	300 x 5	2.04
Shuikou	Minjiang	Fujian	1993-1996	0.7	G	101	43.5	1728	200 x 7	4.95
Wuqiangxi	Yuanshui	Hunan	1994-1996	2.02	G	87.5	42	2050	240 x 5	5.37
Gezhouba	Changjiang	Hubei	1981-1989		BA	47	18.61	4300	170 x 2 125 x 19	14.1
Geheyan	Qingjiang	Hubei	1993-1994	2.2	AG	151	99	390	300 x 4	3.04
Guangzhou Pumped Storage	Tributary of Liuxi River	Guangdong	1993-1994	0.01/0.01 (U/D)	R	68/34 (U/D)	523/542 (G/P)	222/273 (G/P)	300 x 4	2.38/3.14 (G/P)
Guangzhou Pumped Storage	Tributary of Liuxi River	Guangdong	U.C.						300 x 1 *300 x 3	
Yantan	Hongshuihe	Guangxi	1992-1995	1.53	G	111	55.5	1780	302.5 x 4	5.37
Ertan	Yalongjiang	Sichuan	U.C	3.37	A	240	155	1670	550 x 2 *550 x 4	17
Tianshengqiao II	Nanpanjiang	Guizhou Guangxi	U.C	6.701	R	180	110	612	300 x 1 *300 x 3	5.38
Tiansheng-qiao I	Nanpanjiang	Guizhou Guangxi	U.C	6.701	R	180	110	612	300 x 1 *300 x 3	5.38
Manwan	Lancangjiang	Yunnan	1993-1995	0.26	G	128	83.5	1200	250 x 5	5.48
Liujiaxia	Huanghe	Qinghai	1987-1989	4.15	G	147	100	877	225 x 4 260 x 1	5.58
Longyang-xia	Huanghe	Gansu	1969-1974	4.15	G	147	100	877	320 x 4	2.7
Lijiaxia	Huanghe	Qinghai	U.C	79.38	G	155	120	416	400 x 3 *400 x2	8.67
Xiaolangdi	Huanghe	Henan	U.C	5.1	R	154	112	312	300 x 1 *300 x 5	5.1
Tianhuang-ping pumped storage		Zhejiang	U.C						*300 x 6	

Name	River	Province or Autono-mous Region	Year of Commi s-sioning	Active Storage (Gm)	Dam Type	Dam Heigh t (M)	Design Head	Average Discharge (M/s)	Installed Capacity (Mw X No. of Units)	Annual Output
Gongzui	Daduhe	Sichuan	1971-1977 1992-1994	0.096 0.063	G G	85.58	4831	15301500	100 x 7 150 x 4	4.12 3.21
Three Gorges Project	Changjiang	Hubei	U.C	165	G	175	80.6	14300	*700 x 26	84
Dachaosh an	Lancangjiang	Yunnan	U.C	0.94	G	115	72.5	1330	*225 x 6	5.33

Source: *Electric Power, Industry in China*. State Power Corporation, 1999.

Appendix 3. China Thermal Power Plants under Construction

Project Name	Location	Installed Capacity (MW)	Construction Period	Source of Financing
Thermal Power				
Tuoketuo (1st phase)	Inner Mongolia	2 x 600	1996-2000	WB
Jiujiang	Jiangxi	2 x 300-350	1996-2000	WB
Waigaoqiao (2nd phase)	Shanghai	2 x 1000	1997-2002	WB
Jiaxing (2nd phase)	Zhejiang	4 x 600	1996-2003	
Shidongkou No. 2 (2nd phase)	Shanghai	2 x 600	1998-2003	
Yangchen	Shanxi	6 x 350	1996-2002	
Hefei	Anhui	2 x 350		JVC
Fuyang	Anhui	2 x 600		AsDB
Hancheng	Shaanxi	2 x 600		OECF
Wenzhou	Zhejiang	2 x 300		JVC
Baima (CFB)	Sichuan	1 x 300		
Wangqu	Shanxi	2 x 600		

Source: *Electric Power, Industry in China*. State Power Corporation, 1999.

Appendix 4. Principal Thermal Plants/Units under Construction (1000 MW and above)

Name of Plant	Location (Province, Municipality and Autonomous Region	Plant Capacity		Unit Capacity and number (MW X Nos)	Steam Condition		Fuel
		Design	Existing		Pressure (MPa)	Temp. Celsius	
Thermal Power Plant under Construction							
Hanfeng	Hebei	1320		*660 x 2	16.8	540/540	coal
Xibaipo	Hebei	1200	900	300 x 3 *300 x 1	16.67 16.67	537/537	coal
Shalingzi No. 2	Hebei	1200		*300 x 4	16.67	537/537	coal
Yangcheng	Shanxi	2100		*350 x 6	16.6	538/538	coal
Yangquan No. 2	Shanxi	1200	900	300 x 3 *300 x 1	16.67 16.67	537/537 537/537	coal
Shuangliao	Jilin	1200	600	300 x 2 *300 x 2	16.67 16.67	537/537	coal
Suizhong	Liaoning	1600		*800 x 2	23.54	540/540	coal
Daqi	Inner Mongolia	1320	990	330 x 3 330 x 1	16.60 16.60	538/538 538/538	coal
Tongliao	Inner Mongolia	1200	800	220 x 4 *220 x 2	12.75 12.75	535/535 535/535	coal
Yimin	Inner Mongolia	1000	500	500 x 1 500 x 1	23.54 23.54	540/540 540/540	coal
Huaneng Nantong	Jiangsu	1400	700	350 x 2 *350 x 2	16.60 16.60	538/538 538/538	coal
Yangzhou No. 2	Jiangsu	1200	600	600 x 1 *600 x 1	16.80 16.80	540/540	coal
Beilun II	Zhejiang	1800		*600 x 3	16.67	537/537	coal
Jiaxing	Zhejiang	3240	600	300 x 2 *660 x 4	16.67 16.8	540/540	coal
Luohe	Anhui	1200	900	300 x 3 300 x 1	16.20 16.67	550/550 537/537	coal

Name of Plant	Location (Province, Municipality and Autonomous Region	Plant Capacity		Unit Capacity and number (MW X Nos)	Steam Condition		Fuel
		Design	Existing		Pressure (MPa)	Temp. Celsius	
Qingdao	Shangdong	1011	711	300 x 2 *300 x 1	16.67 16.67	537/537	coal
Houshi	Fujian	3600		*600 x 6	24	540/566	coal
Huaneng Fuzhou	Fujian	1400	700	350 x 2 *350 x 2	16.60 16.60	538/538 538/538	coal
Xiangfan	Hubei	1200	300	300 x 1 *300 x 3	16.67 16.67	537/537 537/537	coal
Fengchen	Jiangxi	1200	900	300 x 3 *300 x 1	16.67 16.67	537/537	coal
Baoji No. 2	Shaanxi	1200	300	300 x 1 *300 x 3	16.67 16.67	537/537 537/537	coal

Unit capacity and number with * signs indicate the generating units under construction
Generating units with capacity smaller than 100 MW are not listed in the table.

Source: *Electric Power, Industry in China* . State Power Corporation, 1999.

Appendix 5. Guangdong Power Projects 2001-2010

Projects	Size	Increased Capacity (MW) 2001-2010
Zhuhai power plant	2 x 660 + 4 x 660	1200
Taishan power plant	2 x 660 + 6 x 660	2400
Shenzhen East power plant	4000	2000
Panyu power plant	4 x 660	1980
Maoming Kerogen Shale power plant	600	400
Xiaowan Hydro-power station		2520
Yangjiang Nuclear power plant	6 x 1,000	4000
North Guangdong Nuclear power plant	4 x 1,000	4000
Taishan Nuclear power plant	4 x 1,000	4000
Daya Bay Lingao Nuclear power plant	4 x 1,000	4000

Source: United States Department of State. *China Guangdong Power Generation* , 1998.

Appendix 6. Business Do's and Don'ts

Do:

- familiarize yourself with China's culture, politics, business and social practices;
- understand that respect — amply seasoned with a knowledge and understanding of the Chinese culture — will be a critical building block in the foundation of a commercial relationship;
- enlist the assistance of the Government of Canada through its various departments, offices, Consulates General and the Canadian Embassy in Beijing;
- take advantage of Government-supported trade initiatives, e.g. Team Canada visits;
- become familiar with Canadian public policies and public- and private-sector initiatives designed to provide a competitive advantage to Canadian companies;
- be aware, if your company is an SME, that market access will likely occur more quickly if you are part of a consortium;
- note the advantages inherent in offering attractive financing options;
- become familiar with the advantages/disadvantages afforded by joint ventures with Chinese companies. Wholly owned foreign companies, technology transfer arrangements, trading companies and establishment of local sales offices are also options that require examination;
- recognize the value of early and frequent visits to project sites to meet key contacts and maintain relationships;
- adopt visible marketing and promotion tools — in the appropriate form of Chinese — that inform potential customers of who you are, what you do and how to contact you;
- be aware that thoughtful, targeted marketing can result in your product becoming the "preferred" one;
- note that for most large procurements, pre-qualification of your product will likely be necessary;
- have your agent or advisor research relevant aspects of the opportunity and establish contact with key officials at the project management as well as municipal, provincial and central government levels;
- allow your agent or advisor to advise you on, and facilitate, meetings and subsequent negotiations;
- instruct your agent or advisor to keep you apprized of the trading practices in China of other foreign exporters; and
- recognize that major contracts are often lost over minor misunderstandings. Rely on your agent's or advisor's knowledge and never "infer" or "assume" what terms mean or what type of response is required to a communication.

Do Not:

- visit China on a speculative, unassisted basis;
- compete with low-tech domestic airport equipment manufacturers; and
- assume that corrupt officials control regional markets because new laws are not being policed. New laws are not implemented overnight but the changes *are* being made!

READER EVALUATION

Please help the Market Research Centre to produce market reports that meet your information needs by completing this evaluation form and returning it by fax (613) 943-1103. Thank you for your valuable input.

1. How did you obtain a copy of this market report?
   - ☐ InfoCentre FaxLink system
   - ☐ InfoCentre help line
   - ☐ Local government office
   - ☐ Government Internet site
   - ☐ Other: _____

2. How would you describe this market report?

	Strongly agree	Agree	No opinion	Disagree	Strongly disagree
Useful	☐	☐	☐	☐	☐
Complete	☐	☐	☐	☐	☐
Well organized	☐	☐	☐	☐	☐
Well written	☐	☐	☐	☐	☐
Ideal length	☐	☐	☐	☐	☐

3. In what form do you prefer to obtain these reports?
   - ☐ Print
   - ☐ Electronic

4. Based on the information in this report, what specific action(s) does your organization plan to take in this market? Check all that apply.
   - ☐ Seek an agent/distributor
   - ☐ Visit the market
   - ☐ Do more research
   - ☐ Other: _____
   - ☐ Contact Canadian trade office abroad
   - ☐ Participate in a trade show abroad
   - ☐ Nothing

5. What other market reports would be of benefit to your organization? Please identify specific products and countries. _____

6. Which of the following categories best describes your organization? Check one only.
   - ☐ Processor/manufacturer
   - ☐ Trading house
   - ☐ Export service provider
   - ☐ Industry/trade association
   - ☐ Government
   - ☐ Student/academia
   - ☐ Consultant
   - ☐ Other: _____

7. What were your organization's total sales last year, in Canadian dollars?
   - ☐ Less than $10 million
   - ☐ More than $50 million
   - ☐ $10 million to $50 million
   - ☐ Not applicable

Additional comments/suggestions for improvement: _____

OPTIONAL — The name of your organization is: _____